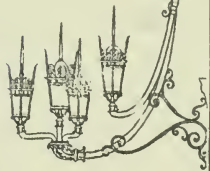


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SECTION 4(f) STATEMENT

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Little Mystic Channel Crossing
Charlestown, Boston, Massachusetts**

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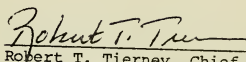
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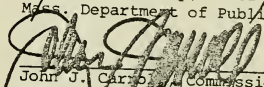
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LITTLE MYSTIC CHANNEL CROSSING
CHARLESTOWN, BOSTON, MASSACHUSETTS

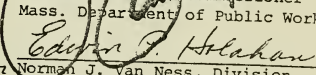
ADMINISTRATIVE ACTION
DRAFT
NEGATIVE DECLARATION
Section 4(f) Statement
U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration
AND
COMMONWEALTH OF MASSACHUSETTS
Department of Public Works

Submitted pursuant to 42 U.S.C. 4332(2) (c),
23 U.S.C. 128 (a) 49 U.S.C. 1653(f)
and 16 U.S.C. 470(f)

June 17, 1977
Date


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Wallace, Floyd, Ellenzweig, Moore, Inc.	Project Management Land Use, Historic
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Economics Research Associates Inc.	Economics
Murray D. Segal	Transportation
Cambridge Accoustical Associates Inc.	Noise
Walden Research Division of Abcor	Air Quality
Process Research Inc.	Water Quality

During the course of the study meetings were held with public officials, representatives of public and civic groups, as well as with interested private citizens. The cooperation of all participants is gratefully acknowledged.

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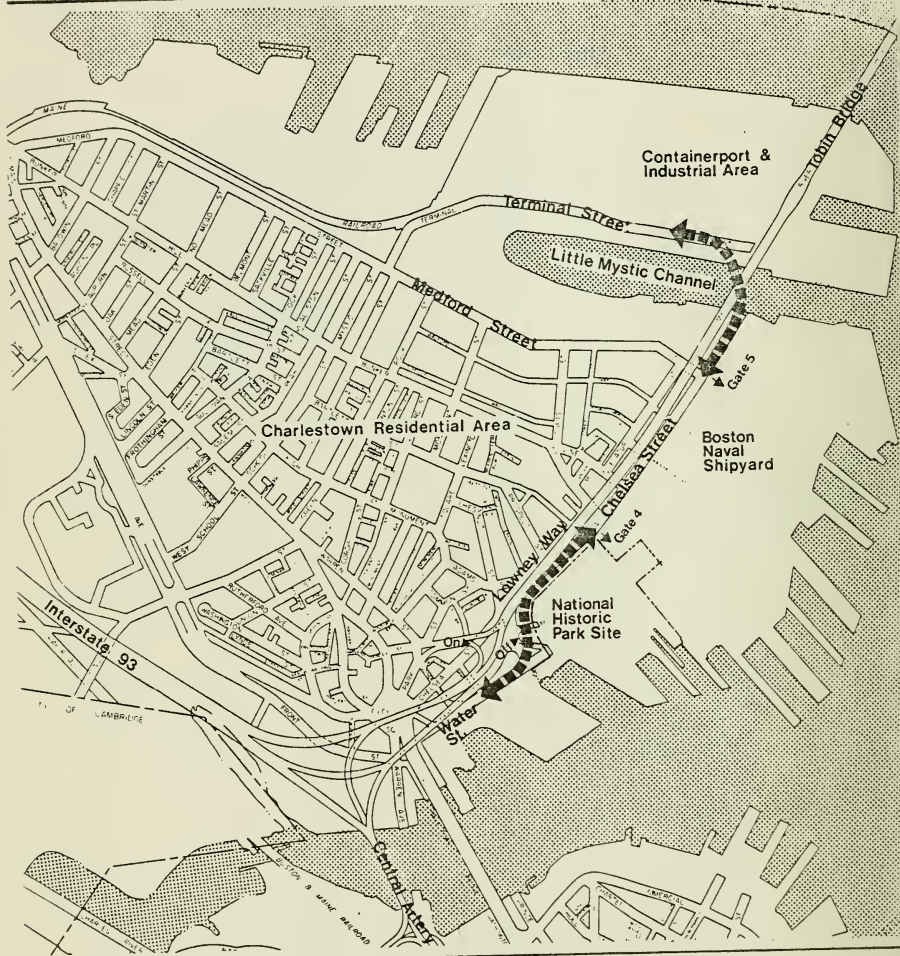
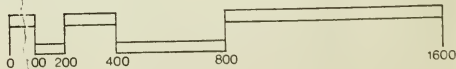


Figure 1a

Purpose of the Proposed Improvement

Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



Chapter 1

Summary of Anticipated Impacts

A. Administrative Action

Federal Highway Administration
Negative Declaration

- (x) Draft () Final
- (x) Section 4(f) Statement
- (x) Section 106 Statement
- () Technical Appendices (separate document)

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B. Proposed Action

The proposed action is the connection of Chelsea and Water Streets as a 4 lane arterial street and the construction of a bridge across the Little Mystic Channel connecting Chelsea and Terminal Streets in the Charlestown section of Boston, Massachusetts. The project would begin 150 feet south of the present Tobin Bridge Approach northbound off-ramp and end 100 feet north of the Little Mystic Channel.

C. Objectives of the Proposed Improvements

The proposed action meets long standing transportation objectives of improving access, reducing congestion, and increasing safety for existing and anticipated traffic in eastern Charlestown. Since the construction of the Tobin Bridge in 1948, through traffic has detoured on local streets; heavy trucking has especially impacted the east end of Medford Street and Lowney Way. The expected increase in traffic due to growth of the Terminal Street industrial area, the development of a National Historical Park in the Boston Naval Shipyard, and reuse of the northern Shipyard will exceed the capacity of the existing street system in 1985 and 1995.

By providing more direct routes with better flow characteristics for through traffic, the proposed improvements will also increase safety, reduce through traffic, noise, and air pollution in the affected residential areas of Charlestown. (See Figure 1a.)

1.D. Other Federal Actions in the Area

Charlestown is the site of many past, present, and proposed federal actions. Those directly related to the proposed improvements include the development of the National Historical Park in the former Boston Naval Shipyard and at the Bunker Hill Monument. The Departments of Housing and Urban Development (HUD) and of the Interior (DOI) and the Economic Development Administration (EDA) are expected to assist the City of Boston in its efforts to redevelop the northern portion of the Shipyard.

Other federal actions in Charlestown include extensive urban renewal activities: new and rehabilitated housing and shopping; removal of elevated MBTA viaduct; construction of the relocated Orange Line; improved expressways and local streets through U.S. Department of Transportation programs.

1.E. Description of Alternatives

One No-Build and four Build alternatives were evaluated. Build alternatives were developed and selected through an open consultative planning process involving state and city agencies and a series of public meetings in Charlestown. The four Build alternatives evaluated (2, 2A, 3, and 4) cover a wide range of cost, engineering complexity, and visual character in connecting Chelsea and Water Streets, but they use the same bridge design to cross the Little Mystic Channel and the same link between the connector and the bridge.

NO BUILD

The road system would remain as it is today. (See Ch. 4, p. 30; Plates 1, 1P; the plates which are at the end of this report fold out so that plans of the alternatives are visible while the report is being read.)

LITTLE MYSTIC BRIDGE

A highway bridge connecting Chelsea and Terminal Streets across the Little Mystic Channel is an integral part of each build alternative. Coast Guard approval of final design is required. (See Ch. 4, p. 29; Plates 5, 5P and 6, 6P.) Estimated cost of a curved bridge is \$2.22 million for a 2-lane crossing and \$2.60 million for a 4-lane crossing. Estimated cost of a straight bridge is \$1.40 million for a 2-lane crossing and \$1.62 million for a 4-lane crossing.

ALTERNATIVE 2

Divided at-grade connector with northbound off-ramp. The northbound and southbound lanes of the four lane connector between Chelsea and Water Streets are split between Gray Street and a point west of the Commandant's House in the Shipyard. The Tobin Bridge Approach off-ramp passes under the southbound connector to merge with the northbound connector lanes (see Ch. 4, p. 30; Plates 2, 2P). Estimated

cost is \$4.29 million with connector, link and 4-lane curved bridge or \$3.31 million with connector, link and 4-lane straight bridge.

ALTERNATIVE 2A

Divided at-grade connector with north and southbound off-ramps. This alternative is similar to Alt. 2 but the off-ramp allows a southbound turn onto Water Street towards City Square (see Ch. 4, p. 31; Plates 2A, 2AP). Estimated cost is \$4.36 million with connector, link and a 4-lane curved bridge and \$3.38 million with connector, link, and a 4-lane straight bridge.

ALTERNATIVE 3

Tunnel connector with north and southbound off-ramp. The Chelsea Water Street connector would be in a tunnel from Henley Street to a point just north of the Commandant's House. A circular off-ramp permitting both north and southbound turns passes over the tunnel and intersects Water Street. (See Ch. 4, p. 31; Plates 3, 3P.) Estimated cost is \$10.03 million with connector, link, and a 4-lane curved bridge or \$9.05 million with connector, link, and a 4-lane straight bridge.

ALTERNATIVE 4

Undivided at-grade connector with north and southbound off-ramp. Northbound and southbound lanes of the connector are not separated. An off-ramp permitting north and southbound turns intersects the connector at grade at a signalized intersection (see Ch. 4, p. 32; Plates 4, 4P). Estimated cost is \$3.79 million with connector, link, and a 4-lane curved bridge or \$2.81 million with connector, link and a 4-lane straight bridge.

Alternatives 2, 2A, and 3 are designed to meet the traffic demands of maximum anticipated 1995 development. Alternative 4 is designed to serve the traffic demands of less than full development by 1995; it provides less capacity and costs less to build and maintain.

PREFERRED ALTERNATIVE

Alternative 4 with either the curved or straight bridge crossing is the preferred alternative. Unlike Alts. 2, 2A, and 3, it is designed to serve the traffic demands of less than maximum Shipyard development by 1995. As a result it costs less to build and maintain and is compatible with proposed reconstruction of the Tobin Bridge approach ramps.

F. Impacts

The impacts of Alt. 1 (No Build) are indirect and will be felt primarily through deteriorating traffic service and safety, air pollution, and noise in already heavily im-

pacted residential areas of Charlestown; potential economic and National Park development will be severely constrained.

The direct and indirect impacts of the four Build alternatives are generic to construction in the corridor east of the Tobin Bridge. However, because Alt. 4 provides less capacity, its traffic and air quality effects differ slightly from those of Alts. 2, 2A, and 3. All Build alternatives provide much better and safer transportation service than the No-Build; thus improving access and encouraging development of the National Park, northern Shipyard, and Moran Terminal expansion while relieving residential areas of through traffic and its attendant impacts. Air quality, noise, water quality, and other natural resources are slightly better than or equal to conditions with the No-Build in the design years 1985 and 1995. Community cohesion and access to public facilities are much improved over the No-Build as are local, sub-regional, and regional economic potential. One business, a tavern, is displaced; no other private land takings are involved. Alts. 2, 2A, and 4 permanently take approximately 1/4 acre from the interior of the historic Shipyard; Alt 3 only requires this taking during construction. All Build Alternatives also take 3/4 acre outside the Shipyard. Landscaping, relocation of the Shipyard wall, improved access to the National Park, removal of traffic bound for the northern Shipyard, and other measures to minimize harm compensate for the taking. Section 4(f) and Section 106 reviews are necessary. Aesthetically, the Build alternatives improve the visual character of the area outside Gate 1 of the Shipyard. The major unavoidable, irreversible long term impact of the proposed improvements is the taking of historically valuable land inside the Shipyard by Alts. 2, 2A, and 4.

Chapter 2

Context and Purpose of the Proposed Improvement

A Proposed Action

The proposed transportation improvements evaluated in this Draft Environmental Impact Statement are to be located in Charlestown, a district of Boston, Massachusetts. The improvements have two elements: the connecting of Chelsea and Water Streets and a bridge to carry Chelsea Street across the Little Mystic Channel. These new facilities are directly related to existing transportation problems in the area and other proposed changes and new developments in Charlestown. See Fig. 1a. The planning and transportation is set forth below.

B Charlestown

Charlestown is located on a peninsula to the north of Boston, bounded by the Charles River, the Mystic River and the inner Harbor. The original hilly peninsula that contained the settlement was expanded by filling around the edges to accommodate industrial development. Geographically isolated from the rest of Boston, the town is traversed by I-93 and the Tobin Bridge. These elevated highways, and the elevated MBTA structure (now dismantled) have had a blighting effect on the town.

Charlestown* is a residential, family-oriented neighborhood with a present population of 16,000. The population has been steadily declining over the last thirty years, though this trend now appears to be reversing. The community's population structure has remained stable, consisting mainly of descendants of Irish settlers from five or six generations ago, Canadians, and recently an influx of young families and single people of varied ethnic background. Over 98 percent of the population is white, mostly clerical or blue-collar workers with a 1970 median household income of \$9,000.

Tax assessments and housing costs are low, and approximately half the units are owner occupied, the mortgages having been paid off long ago.

There are three low and moderate income housing projects in the town. The recent urban renewal efforts and removal of the elevated structure have encouraged interest in the town by outsiders. Private renovation is taking place; a growing number of professionals new to the area are becoming involved in town activities.

*Sections of this description have been taken from the Central Artery Depression Feasibility Study and the Phase I Report, Appendix A.

1. SHIP PLAZA EAST
2. LAND FILL WEST
3. TWO MHA UNITS
4. NEW PARK
5. NEIGHBORHOOD DEVELOPMENT PROGRAM 1 AND 2
6. NAUPOORT PROPERTY
7. NORTH END PARK
8. WATERFRONT URBAN RENOVATION AREA
9. CHARLESTOWN URBAN RENOVATION AREA
10. U.S.S. CONSTITUTION NATIONAL PARK
11. MONUMENT SQUARE
12. BOWDOIN PIER
13. PAUL REVERE LANDING PARK
14. CITY SQUARE PARK
15. NORTH TOWN HIGHWAY IMPROVEMENTS
16. TOWN HILL NATIONAL HISTORIC DISTRICT
17. BUNKER HILL COMMUNITY COLLEGE
18. MBTA STATION
19. POSSIBLE PRINCE PARKING
20. ORANGE LINE TUNNEL
21. NORTH TOWN CONTAINER FACILITY

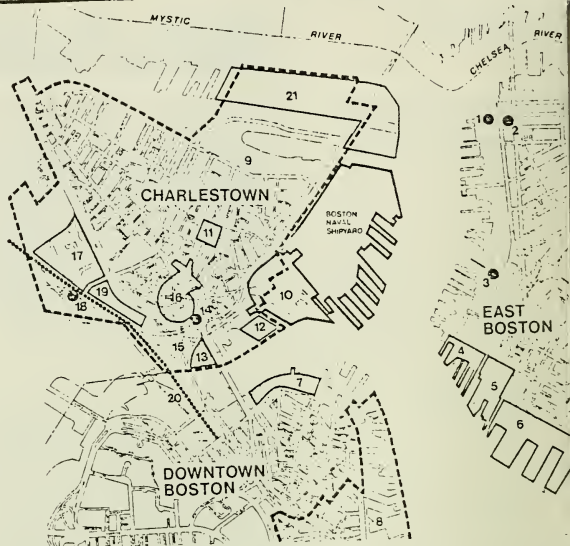


Figure 2a. Planning Context Map

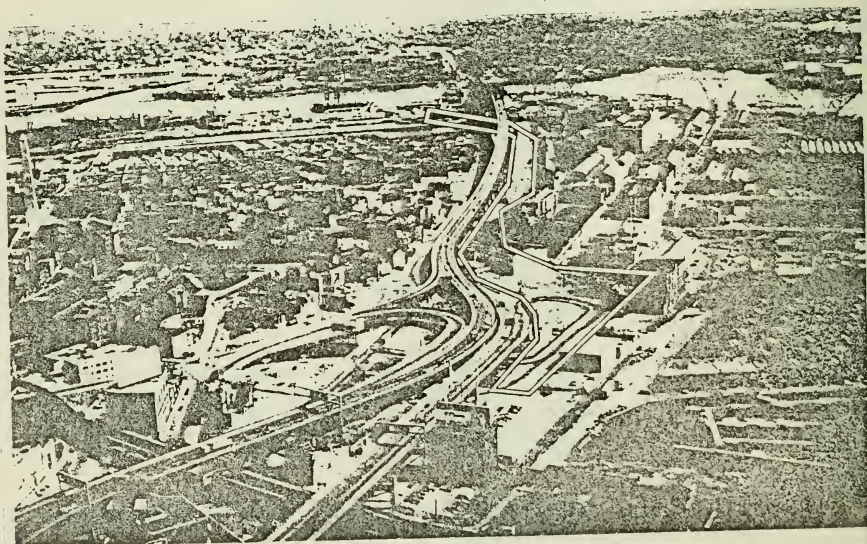


Figure 2b. Corridor of Proposed Action

The proposed roadway and bridge follow alignments which have marked the edge of the residential area for over 20 years. The corridor for proposed transportation improvements runs between the Tobin Bridge (east of the residential areas along Lowney Way, Bunker Hill Street, and Medford Street), and the former Boston Naval Shipyard and Hoosac Pier industrial areas. (See Figure 2b)

The residential neighborhood along the corridor consists of private three to six-story brick row houses and two subsidized housing projects. One, Bunker Hill Housing, is three-story brick apartments, and the other Charles New-Towne Housing is two and three-story brick, concrete, and wood apartments. There are a few local shops along Bunker Hill Street and Medford Street, and two schools in the immediate area. Some houses on the side streets to Lowney Way are currently undergoing renovation and upgrading, and the Massachusetts Port Authority is planning to improve J. A. Miller Square, a small area it owns on Lowney Way.

Major industries on the northern side of Medford Street, west of Terminal Street, are sugar refining and warehousing. Terminal Street provides access for the Moran Container Terminal, U.S. Gypsum, and Schiavone's scrap operations, all on the peninsula north of the Little Mystic Channel. Extending into the harbor to the east of Tobin Bridge are the Boston Naval Shipyard, now decommissioned, the new Boston Naval Shipyard/U.S.S. Constitution National Historic Site, and Hoosac Pier. (See Figure 2a).

C Purpose of the Proposed Improvement

There are two major purposes for the proposed action; to remove truck and other through traffic from residential streets in Charlestown, particularly Medford Street and Lowney Way; and to improve access to the Moran Terminal industrial area.

Since the through traffic is destined mostly for those areas which need improved access, these two purposes reinforce each other strongly. More specifically, the linking of Water and Chelsea Streets will reconnect the street system which was disrupted by the building of the Tobin Bridge. At the time of its construction, in 1949, the bridge interrupted the continuity of Chelsea Street. The new link will divert traffic from Lowney Way, a residential street, to the new road, which is separated from the community by the Tobin Bridge. Cars and trucks destined for the Naval Shipyard and the National Park will exit from the expressway system at Water Street, will pass north on the connection to Chelsea Street and then enter either Gate 4 or Gate 5. A new route to the northern portion of the yard is especially needed because the National Park Service wishes to end all through traffic at Gates 1 and 2. (See Figure 1a.)

The bridge across the Little Mystic Channel will extend Chelsea Street to the Moran Terminal industrial area, providing a by-pass to Medford Street between Terminal and Chelsea Streets. Medford Street is heavily residential.

The proposed improvement is planned to relieve present problems of through traffic on local streets. It will also provide for the traffic increase due to the National Park, the anticipated redevelopment of the northern part of the Shipyard, and the expansion of the Moran Terminal (one of the two container shipping areas in Boston).

2.D Planning Basis of the Proposed Improvement

The action of connecting Chelsea and Water Street and providing a bridge across the Little Mystic Channel is part of a complex planning effort for the reuse of the Boston Naval Shipyard and traffic improvements in Charlestown. The planning is being done through cooperation of a number of agencies at all levels of government, with the general leadership of the Boston Redevelopment Authority. Federal agencies are providing both planning support and funds in various categories for project development.

The former Boston Naval Shipyard is being redeveloped as a National Park Site and other uses are proposed, such as hotel, institutional, housing, commercial and light industry.

Traffic circulation improvements are also under consideration for City Square. The proposed improvement is part of the access and circulation system now being planned for the new uses. Specific plans for entry gates to the Shipyard and parking to accommodate new demand will be provided by the agency planning efforts; new access from the expressway is provided by the connection and bridge evaluated in this DEIS.

The bridge is especially important in attaining community goals for the removal of trucks from local streets. Mass Port's plans to expand the container handling capability at Moran Terminal and its interest in improving the environment in Charlestown will both be served by the bridge. Without the connector and bridge, development on the Shipyard site would be restricted to the capacity of the local streets, thereby reducing the feasibility of the reuse plan.

2.D.1 Planning Agencies

As a part of the City of Boston and the metropolitan region, Charlestown's planning is conducted by a number of agencies on different levels of government with a variety of special concerns. The Boston Redevelopment Authority carries out local planning and zoning activities through a district

planner assigned to the town. The BRA also manages the urban renewal projects, and coordinates local transportation projects with the Massachusetts Department of Public Works. The redevelopment of the Naval Shipyard is a special effort of the BRA and the city's Economic Development and Industrial Commission. The National Park portion of the Shipyard is being developed by the National Park Service with the cooperation of the BRA.

Local street planning is the responsibility of the BRA, and the city's Department of Traffic and Parking, with the involvement of the MDPW in larger projects. Expressway planning is done by MDPW. The Massachusetts Port Authority administers the Tobin Bridge, the Port including container shipping, and coordinates with the other agencies in planning. The Massachusetts Bay Transportation Authority operates the buses and transit trains which serve Charlestown.

The Executive Office of Transportation and Construction, The Massachusetts Department of Public Works, the Metropolitan Area Planning Council, The MBTA and the Advisory Board to the MBTA have jointly established two groups which are involved in transportation planning in the region. The Joint Regional Transportation Committee provides overall policy guidance in matters of areawide concern in transportation decision making. The Central Transportation Planning Staff conducts long-range transportation planning and analyses for major transportation policy issues and assists the agencies in developing particular transportation projects and programs.

2.D.2 Planning Process

Planning efforts are generally sponsored by the agencies within the responsibilities outlined above, and are carried out in coordination and consultation with the other concerned agencies. Citizen participation is an element of both BRA and MDPW project planning process. The proposed action has been jointly planned in large part by the BRA and MassPort. The connection and bridge further, the planning objectives of both agencies.

2.D.3 Previous Related Studies

The proposed action has been an element of possible improvements in Charlestown and the North Terminal Area for many years. The most relevant studies are summarized below. A complete bibliography appears in Appendix A.

Engineering Economic Study, Mystic River Development Project, 1969. MassPort commissioned this study as an aid in their plans for the Mystic Pier Area. It considered,

but did not recommend a bridge across the Little Mystic from Chelsea Street to Terminal Street.

North Terminal Evaluation Study, 1972. Following a 1971 decision to terminate plans for a high level bridge from Leverett Circle to City Square, this study for the Metropolitan District Commission and the North Terminal Technical Advisory Committee recommended connecting Leverett Circle and I-93 by a low level bridge across the locks at the new Warren Avenue Dam. The Chelsea-Water Street link and Little Mystic Channel Bridge were not investigated.

Feasibility Study for Bridge Crossing of Little Mystic at Chelsea Street, 1972. The BRA felt the bridge had merit in removing traffic from local streets, and so had this study done to determine its feasibility.

North Terminal Review Draft Environmental Impact Statement, 1973. This study for Massachusetts Department of Public Works evaluated the impact of five possible schemes, three including connection of Chelsea and Water Streets. This report has not been circulated, and none of the alternative is under active consideration.

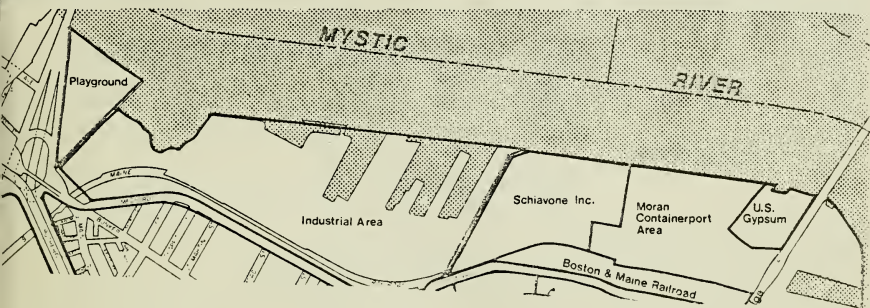
A Proposal for a National Historic Park and Naval Museum, Charlestown Navy Yard, 1973, Boston Redevelopment Authority. This proposal documented the historic buildings and suggested a National Park based on the Shipyard and the USS Constitution.

Land Use and Transportation Study, Boston Naval Shipyard, 1974. The BRA and the city's Economic Development and Industrial Commission sponsored this study to develop possible reuse plans for the Shipyard, and to identify solutions to the access problems of the yard. It recommended the Chelsea-Water Streets connection, and mentioned the possibility of the bridge over the Channel.

Container Port Study, 1974. This study for MassPort, the BRA, and the Boston Shipping Association, examined the expansion possibilities of existing container facilities, as well as possible new sites. One of the elements favoring expansion of Moran was the possibility of improved truck access to be provided by a low level bridge across the Little Mystic Channel to Chelsea Street.

Central Artery Depression Feasibility Study, BRA; 1975. The goals for Charlestown within the larger purpose of this study were to reduce traffic on Lowney Way and to continue to provide all traffic movements available today.

The John F. Kennedy Museum, Charlestown Naval Shipyard/A Proposal, BRA 1975. This brochure proposed locating the Kennedy Museum on Shipyard property outside the National Park. The Chelsea-Water Street connection and the Little Mystic bridge were presented as a way of achieving improved access to the site.



Boston Naval Shipyard, An Alternative for Development, National Park Service, 1975. This is the Park Service's initial planning document. It recognizes the need for linking Chelsea and Water Streets to provide access, and as a way of eliminating through traffic from the proposed park area.

Boston Naval Shipyard at Charlestown, Plan and Development Program, BRA, 1975

2.D.4 Current Planning Efforts

Urban Renewal. Charlestown has undergone extensive urban renewal including new housing, a commercial shopping area, a new community college, renovated housing, realigned and new streets. The project is now nearing completion.

Removal of El. The MBTA completed in October, 1975 the removal of the elevated structure which carried mass transit trains from North Station through Charlestown along Main Street. New service is being provided at the Community College station on the Orange Line which has been extended to Wellington Circle in Everett.

City Square. Plans to minimize traffic congestion and improve the traffic flow in City Square have been prepared recently by the BRA and MDPW with guidance from the Charlestown community. Planned improvements include new traffic and pedestrian signals, channelization and expanded community open space areas.

These improvements, in conjunction with the removal of the MBTA elevated rapid transit structure, are being designed to serve the proposed connection between Chelsea and Water Streets and to provide improved access to the National Park and Shipyard sites. The plan calls for an improved Joiner Street to serve as the transportation link between City Square and the proposed Chelsea-Water Connector. An interim City Square pattern is in effect until the proposed design plans are completed.

Depression of the Central Artery. MDPW is at the beginning planning stages of this long term proposal. The physical impact of this project in Charlestown would be in the City Square to Tobin Bridge corridor. The proposed build alternative actions which are the subject of this DEIS are to be accomplished in advance of Central Artery changes and do not preclude those improvements. All such plans follow the broad policy outlines developed during the Boston Transportation Planning Review.

National Park Plans. The National Park Service (NPS) acquired the southern end of the Shipyard in early 1976 and is currently developing park themes and exhibits for interpretive purposes and refurbishing buildings. The NPS and the

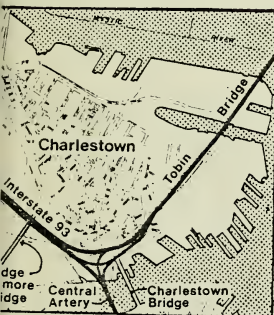
BRA (responsible for redevelopment of the northern Shipyard) are jointly planning future access points, parking areas, and possible tour and MBTA bus drop-off areas. NPS would like to use Gate 1 for pedestrian access only and either Gate 4 or Gate 5 for autos and service vehicles.

Since the NPS wishes to end all through traffic in the Park, it in principle approved the need for a Chelsea-Water Streets connector.

Northern Shipyard. Initial planning for the reuse of the northern part of the Naval Shipyard was undertaken by EDIC and BRA jointly. The BRA is now planning for the following major uses: several museums and institutions, housing, hotel, convention center, retail and restaurant, marina, and some light industry. The access to this development will be primarily through Gate 5. Some parking will be provided inside the Shipyard for the National Park visitors. There is also the possibility of access to the Shipyard outside the Park through Gate 4.

Rail service to the northern part of the yard may be cut off by the Park Service. There is rail service to Moran Terminal area which could possibly be continued across the Little Mystic Channel. A curved bridge across the channel would allow a rail crossing between Moran Terminal and the northern Shipyard. A straight bridge precludes such a connection.

E Existing Transportation Service

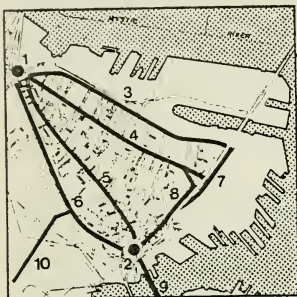


2.E.1 Regional Highway Access

A number of the region's major radial expressways converge in Charlestown and offer the potential for good regional access. The I-93 expressway is a high speed route from the northwest which extends to the outlying population centers in the region. The Tobin Bridge and its connections to the Northeast Expressway, Route 1 and I-95, provide a direct route to the north and northeast (via Route 128). The Massachusetts Turnpike and the Southeast Expressway offer regional access via modern facilities from the west and south through connections to the Central Artery and Tobin Bridge approaches. An additional auto access from the west is available over Storrow Drive-Soldiers' Field Road. All of these routes converge just south of the Shipyard with services concentrated on the City Square ramp system. The Charlestown and Judge Gilmore Bridges, while not tied directly to the regional expressway system, do provide access routes from portions of Somerville, Boston, and Cambridge.

2.E.2 Charlestown Circulation System

The streets which now serve the Charlestown community spread out in a general east-west fan shape from Sullivan Square at the center of the fan. Main Street, Warren Street, Bunker Hill Street and Medford Street form the backbone of this arterial system and serve the bulk of



- | | |
|-----------------------|-----------------------|
| 1. Sullivan Square | 6. Rutherford Avenue |
| 2. City Square | 7. Chelsea Street |
| 3. Medford Street | 8. Lowney Way |
| 4. Bunker Hill Street | 9. Charlestown Bridge |
| 5. Main Street | 10. Gilmore Bridge |

locally oriented traffic. Each of these three streets carries two lanes of moving traffic (one in each direction) and provides the abutting properties with continuous access and a considerable amount of curb parking. During the afternoon peak periods traffic volumes range from 350-550 vehicles depending upon the street and location. (A traffic distribution map for the existing condition will be found in Chapter 5, Figure 5a.) The volumes are lower at the Sullivan Square node than at the easterly nodes, an indication of the downtown to Charlestown commuter pattern. Demolition of the existing MBTA elevated structures on Main Street has just been completed. It is a significant improvement to the level of traffic service.

Traffic circulation in the north-south direction is hindered by the lack of a continuous route across the Charlestown community. For the most part traffic movements oriented in this direction now use Chelsea Street and Lowney Way along the easterly edge of the residential community and then penetrate these areas via Bunker Hill or Medford Street. This route is narrow and indirect and now carries 310-470 vehicles in the afternoon rush hour. Truck volumes are substantial along Lowney Way, Chelsea and Medford Streets.

2.E.3 Traffic Characteristics

Traffic operations in Charlestown are characterized by: heavy through traffic along the periphery of the community on Rutherford Avenue, Interstate 93 and Tobin Bridge; congestion of arterial and expressway traffic within City Square; substantial numbers of trucks on much of the arterial street systems.

Because of its proximity to downtown Boston and its major connections with the regional transportation network, peak hour traffic congestion is not uncommon in City Square. However, the BRA and the MDPW have recently developed a plan with assistance from the Charlestown community for easing traffic conditions in the Area (see Ch. 2.E.4). Briefly, the plan provides for the redirection of major traffic movements away from Main Street and its adjacent residential areas. In addition, a more direct connection between local roadways and the Charlestown Bridge is achieved by separating Main and Chelsea Streets traffic from the predominant flow along Rutherford Avenue. The City Square plan is presently in the engineering design phase. To adequately carry out this plan, several minor traffic operational improvements of a supportive nature will also be performed on the Charlestown Bridge and at Keany Square and downtown Boston.

The presence of truck traffic on Charlestown's arterial streets is largely related to the industrial land uses which line the northerly edge of the community (Moran Ter-

minal, Domino, Revere, etc.). As long as these land uses continue to be active, the demand for truck access to them will exist. At the present time sections of Lowney Way, Chelsea Street and Medford Street carry heavy trucks bound for these industries, and this problem constitutes one of the principal reasons for the present study. Existing truck volumes in the afternoon rush hour are shown in Chapter V.B.

2.E.4 Deficiencies of Existing Facilities

EXISTING PROBLEMS

Within the context of traffic circulation, access and safety, the Charlestown arterial street system exhibits the following problems: lack of a good crosstown route, resulting in poor access to the northern end of the Shipyard and the Moran Terminal; and inefficient traffic operations in City Square due to the complexity of the entering streets and the lack of an effective signalization-channelization scheme.

FUTURE PROBLEMS

The planned redevelopment of the former Boston Naval Shipyard, the establishment of a National Park site on the most historic portion of the Yard, and the expansion of the Moran Terminal will generate large future increases in traffic demand in Charlestown. A full discussion of the traffic impacts of these land use changes appears in Chapter V.B. In general, the principal traffic impact of the land use actions would be to completely overload sections of Chelsea Street, Lowney Way, lower Bunker Hill Street, Vine Street and Hunter Street. Without the connector there is little possibility, in fact, that these streets could handle the rush hour demands even with an intensive effort to manage and control traffic. Therefore, there would either be a general increased infiltration of traffic through residential areas, a lengthening of the rush hour period, or a large reduction in the intensity of residential land uses to avoid these consequences.

Chapter 3

Design Constraints

A number of factors special to the area of the proposed action have heavily influenced the conceptual approach and design of the Alternatives.

A. Community Objectives

One of the primary motivating forces for the improvement has been community pressure to relieve local streets of through truck traffic. Based upon the BRA's continuing involvement in Charlestown and MassPort's work at the Moran Terminal, the following objectives were identified for the project. These aims were favorably received at public meetings.

- a. Minimize trucks on local streets.
- b. Improve access to Moran Terminal industrial area, northern part of Naval Shipyard, and National Park.
- c. Observe National Park objectives; protect historic resources and Park environment.
- d. Feasible cost.
- e. No residential takings.
- f. Other concerns of Charlestown residents (these included pedestrian access to the Park and waterfront and good circulation within the community).

B. Existing Land Uses

For general land uses in Charlestown please refer to Phase I Report, Appendix A. Land uses immediately adjacent to the two proposed improvements (the connector and the bridge) include:

NEXT TO THE PROPOSED CONNECTOR

- . The Bunker Hill Pavilion, a building housing a show depicting the history of Charlestown, sponsored by the Raytheon Historic Foundation on land leased from MassPort.
- . The U.S.S. Constitution and proposed National Historical Park.
- . Land owned by MDPW used for parking and equipment storage.
- . Tavern.

ALONG CHELSEA STREET

- . Land owned by the Boston Housing Authority. It is fenced and paved and is not currently in use.
- . The Tobin Bridge
- . Land under the bridge owned by MassPort used for parking.
- . The former Naval Shipyard under development by the BRA.

NEXT TO THE BRIDGE

- . Barry Playground is an active ball field adjacent to two housing projects.
- . BRA-owned land now leased to MassPort for its terminal operations.
- . Boston and Maine Railroad property used for storage of rolling stock and service to terminal-area industries.
- . MPA easement area.

3.C. Land Available for Locating Improvements

In order to effectively bypass Lowney Way and still provide access to the crucial traffic generators, the most feasible corridor lies to the east of the Tobin Bridge.

In addition to the physical constraints at the Commandant's House (Chapter 3, Figures 3b, 3c), the area in front of the Shipyard entrance and at the Water Street off-ramp is limited by the Shipyard wall, the expressway structure, and development along the waterfront.

3.D. National Historic Park Sites

It is important that the improvement take as little land as possible from the historic Naval Shipyard and do as little damage as possible to the Commandant's House. The designs reflect efforts to minimize these takings and increase the access advantages to be gained for the Park from the proposed action.

3.E. Engineering Factors

THE CENTRAL ARTERY AND THE TOBIN BRIDGE

The Central Artery and approaches to and from the Tobin Bridge are to the west of the proposed Chelsea/Water Street connector. The northbound Central Artery approaches the present Water Street off-ramp on a down grade of 5 percent goes through a sharp reverse curve alignment, and parallels Lowney Way as it is rising to the Tobin Bridge. The Tobin Bridge approach in the vicinity of Henley Street northward is double decked. The upper southbound roadway is carried on viaduct by a series of steel supporting bents spaced approximately 100 feet apart.

The location of the existing Water Street off-ramp is of particular importance to the design of the proposed improvements. Relocating the off-ramp to the north of the optimum location shown in Figure 3a would create a severe weaving condition with traffic using the existing northbound on-ramp. Similarly, relocating the off-ramp to the south increases the problem of Central Artery traffic weaving with merging Interstate 93 traffic. The recommended ramp location minimizes merge and weave movements.

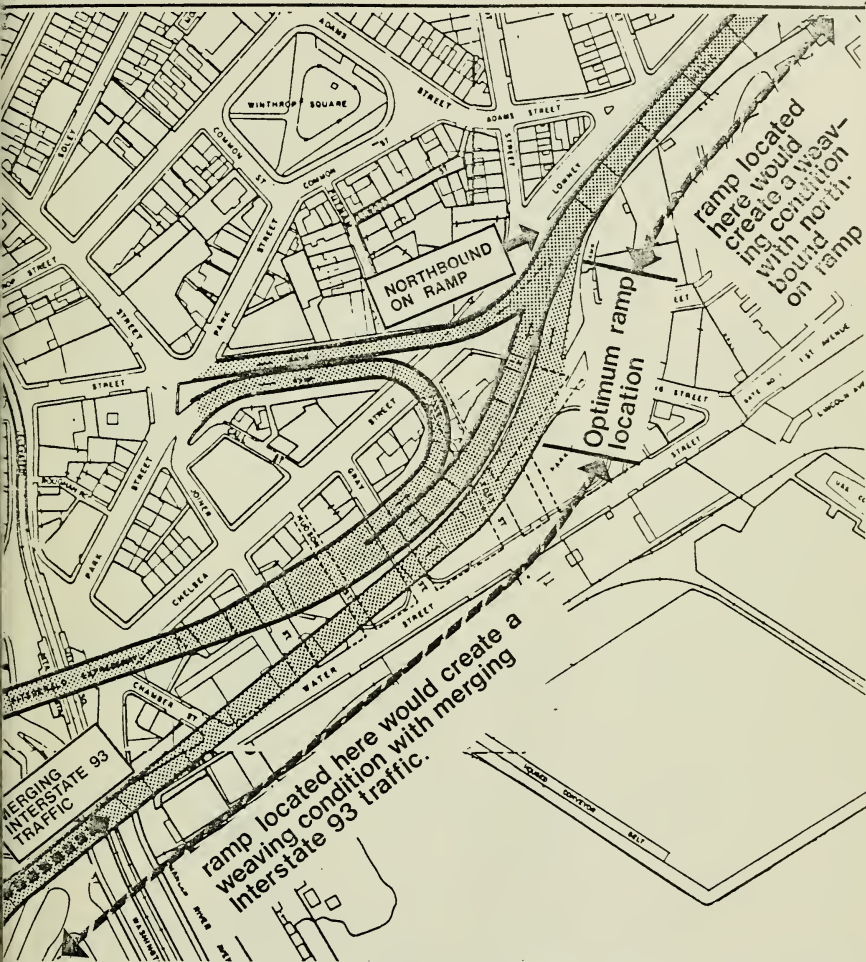
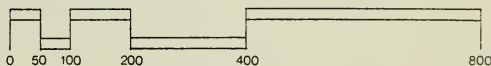


Figure 3a

Off-Ramp Location Constraints

Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



To accommodate a now closed exit at Chelsea Street, the east columns of B-7 and B-8 were constructed adjacent to the Shipyard wall. To provide for the connector, it is proposed to relocate these columns to the edge of the northbound artery. This would require the shortening of bent B-7 by approximately eight feet, and bent B-8 by approximately 22 feet. Traffic can be maintained during construction.

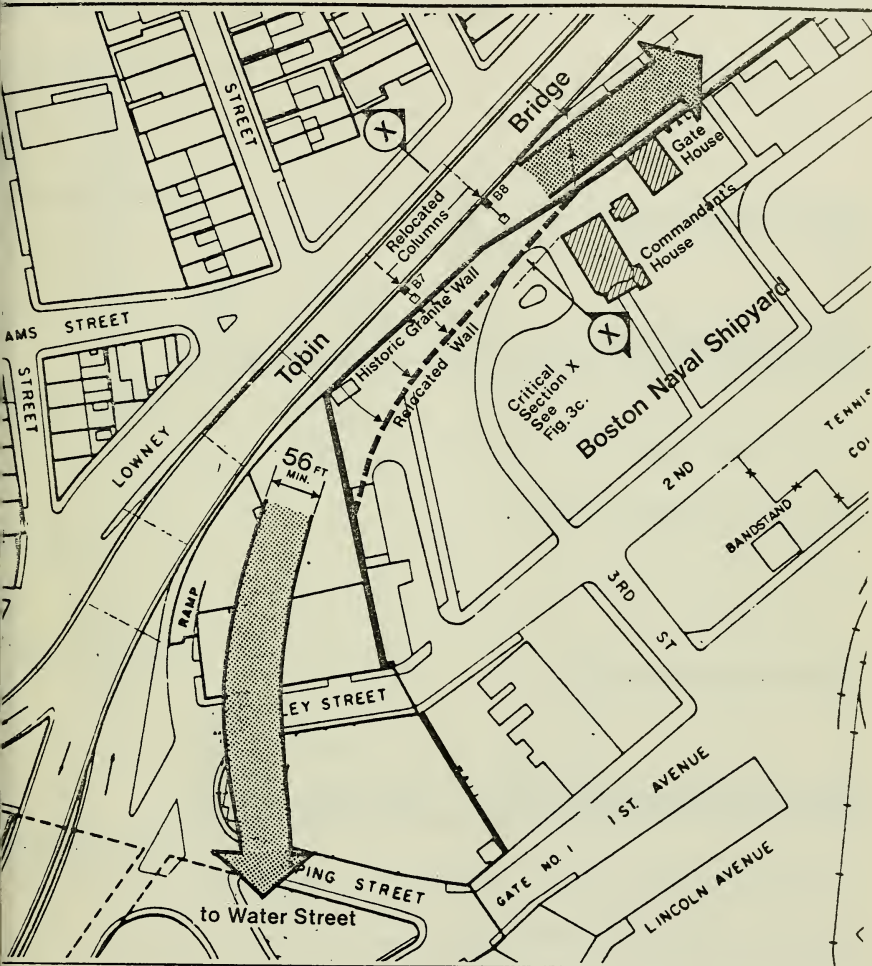
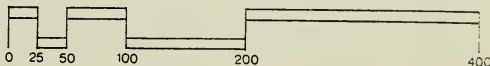
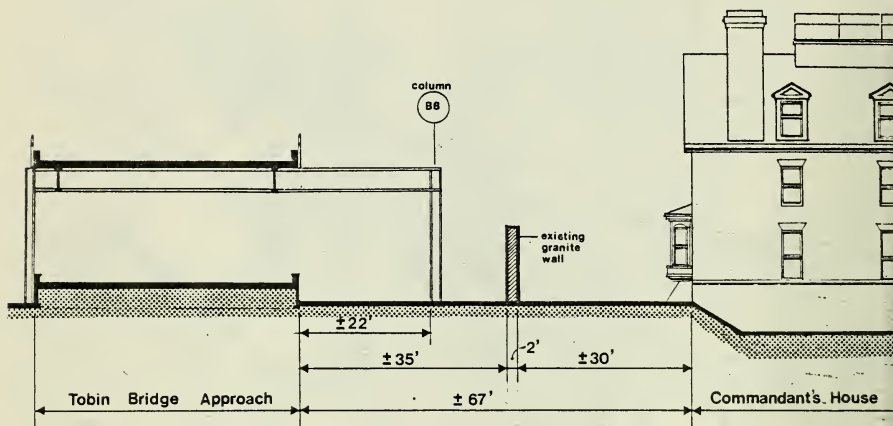


Figure 3b

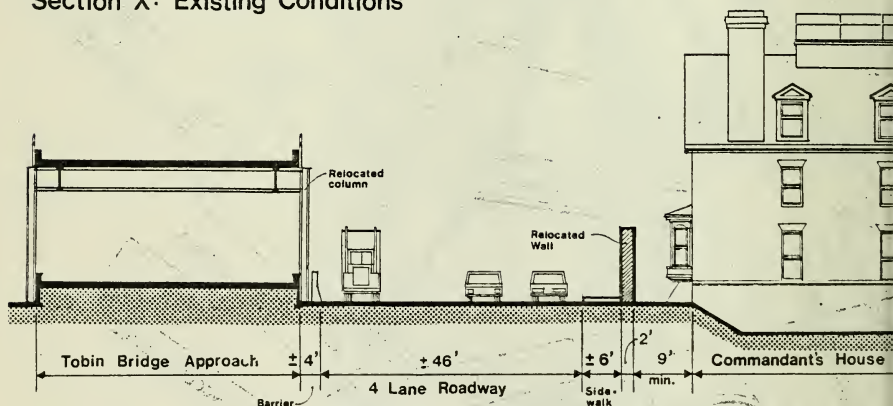
Special Design Considerations

Chelsea-Water Streets Connector - Little Mystic Channel Crossing
Draft Negative Declaration





Section X: Existing Conditions

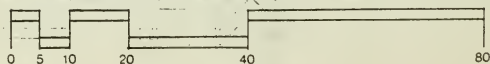


Section X: Proposed Changes

Figure 3c.

Special Design Considerations: SECTION

Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



F. Little Mystic Channel Crossing

The alignment of the bridge connecting Terminal and Chelsea Streets across the Little Mystic Channel is subject to a number of constraints (See Appendix B, for further detail).

The Coast Guard has tentatively indicated they would require a 75 foot wide boat channel with 10 foot under-clearance from any overhead structure at mean high water (elevation 10.23 Boston base). These requirements are subject to further hearing and decisions by the Coast Guard. See Figure 3d.

The Tobin Bridge's 350 foot truss approach spans are carried by piers on either side of the channel. See Figures 3d, 3e and 3f for details of these piers and the area affected by the abutment of a curved or straight Little Mystic Crossing in the MassPort easement under the Tobin Bridge. (See also Ch. 5.J, p. 88 for a description of the easement.) The piers require that either bridge element pass diagonally between the bridge support columns in order to make the crossing and the connection with Terminal Street.

Northern railroad access to the Shipyard enables the National Park Service to meet its stated objective of discontinuing existing rail service from the south through the National Historical Park. See Figure 3d for details. To keep open the possibility of a rail crossing connecting the northern Shipyard with the Terminal Street yards, a curved bridge has been studied. Radii of curvature and grade requirements for railroads are such that the most feasible alignment for the rail crossing is from northwest to southeast. Only the curved bridge accommodates such a rail crossing.

Current land use proposals for the northern Shipyard do not indicate a need for railroad access. A perpendicular highway crossing of the Little Mystic Channel forecloses the possibility of a rail crossing connecting the northern Shipyard with the Terminal Street yards.

A straight bridge is a less expensive, workable alternative. It extends from Chelsea Street under the Tobin Bridge and makes a channelized intersection with Terminal Street. The new bridge has a 3% vertical grade. Although truck and rail movements and storage requirements can be accommodated in the straight bridge alternative, they are less direct and at a lower level of service than in the curved alternative. Mystic Pier 1 operations require that one track to the pier be maintained. In addition, provisions must be made in the intersection for continued access to U.S. Gypsum located to the north.

A curved bridge allows for future rail connection between the Terminal Street rail yards and the northern Shipyard. The need for such a connection is in doubt at this point in time, given the uncertainty of future land uses. In addition to accommodating future rail, a curved bridge provides

Moran Containerport Industrial Area

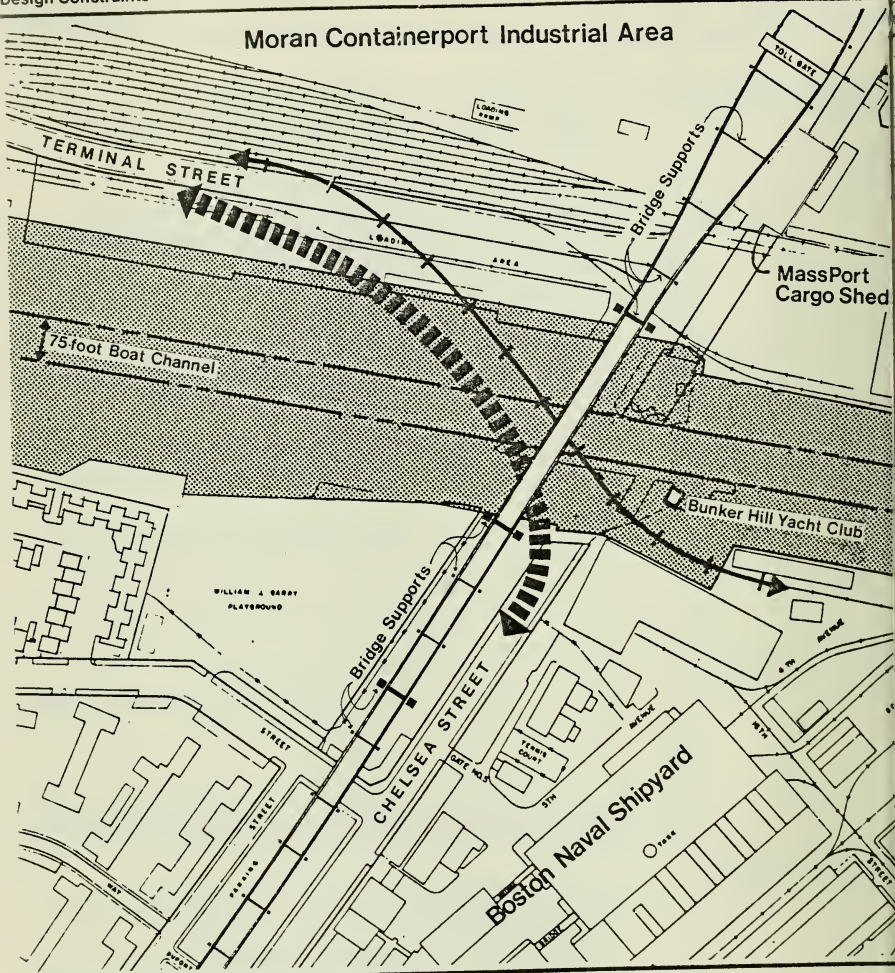
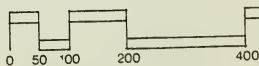
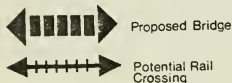


Figure 3d

Bridge Design Constraints

Chelsea-Water Streets Connector · Little Mystic Channel Crossing
Draft Negative Declaration



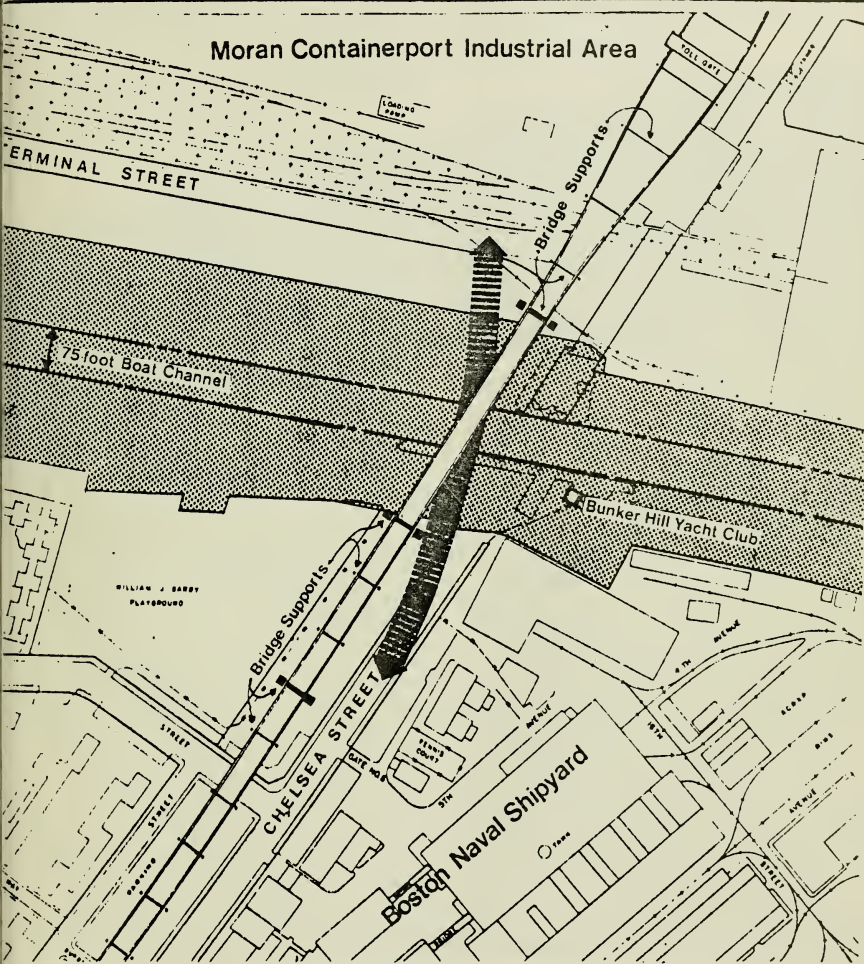
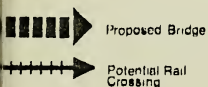
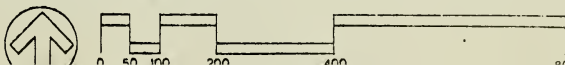


Figure 3e



Bridge Design Constraints

Chelsea-Water Streets Connector - Little Mystic Channel Crossing
Draft Negative Declaration



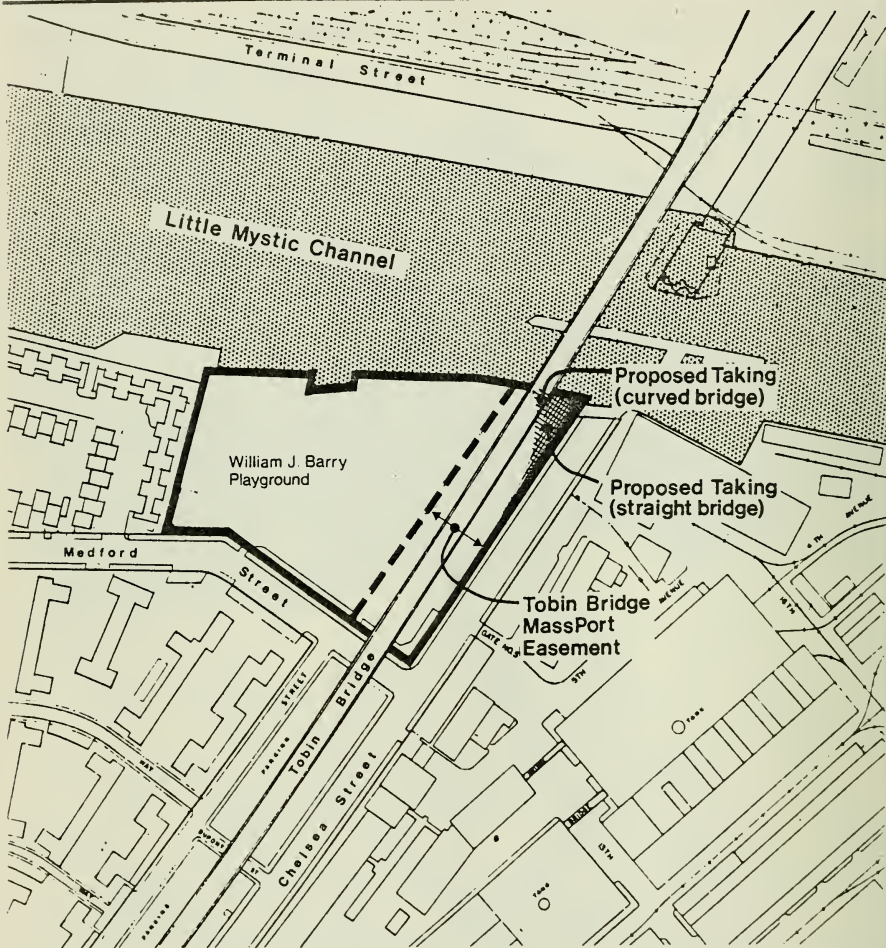
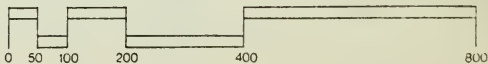


Figure 3f

MassPort Easement

Chelsea-Water Streets Connector - Little Mystic Channel Crossing
Draft Negative Declaration



a larger radius and thus smoother traffic flow for the major truck movement between Terminal Street and Chelsea Street. Truck movements and storage requirements at Mystic Pier 1 are not adversely affected.

To establish maximum costs and impacts, a 4-lane bridge has been studied. Anticipated traffic volumes and the operational requirements of the Moran Terminal suggest that a 2-lane bridge built to MDPW standards would be sufficient; costs would be proportionately lower. Bridge characteristics will be determined during final design.

Chapter 4

Description of Alternatives

A. Descriptions

After reviewing and considering a range of alternatives identified in previous studies and the constraints discussed in Ch. 3, FHWA, MDPW, BRA, MassPort, and CTPS agreed that the following elements were to be part of any build alternative to be studied in detail: a road connecting Chelsea and Water Streets, a modification of the Tobin Bridge Approach off-ramp at Water Street required by the design of the connector, and a bridge over the Little Mystic Channel.

Through a series of public meetings, BRA and MassPort investigated a large number of alternatives to eliminate unfeasible concepts. This process (documented in Appendix A) led to the selection of the five alternatives described below.

Each description of an alternative describes its alignment, construction time, and estimated cost. Detailed cost breakdowns, utility relocation, and recommended construction sequences are described in Appendix C. Plans and profiles of each alternative are provided in foldout plates 1-6 at the back of this book.

B. Alternative 1

ALIGNMENT

The No-Build alternative (see plates 1, 1A) involves no change to the existing street pattern and no bridge is built across the Little Mystic Channel.

CONSTRUCTION

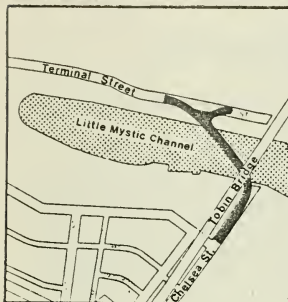
There are no utility relocations, detours, or construction costs.

C. Little Mystic Bridge

ALIGNMENT

The bridge crossing of the Little Mystic Channel (see Plates 5 and 6) is an element of each of the build alternatives. There are two alternative designs, one on a straight bridge alignment and one on a curved bridge alignment. (See Appendix B, pp. 28-32, for details of bridge alternatives.)

The curved bridge starts on the south side at the existing Chelsea Street embankment. The two-way roadway will curve to the west on a radius of 400 feet and provide a sidewalk on the west side. The bridge will provide for a 75-foot



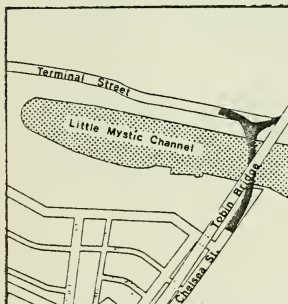
wide boat channel with a minimum underclearance of 10 feet above mean high water (elevation 10.23 Boston base) in accordance with Coast Guard requirements. After the bridge passes over the boat channel, it will descend to Terminal Street. Once past the north abutment, the roadway will be on an embankment and will provide an easterly ramp to Pier No. 1. The bridge superstructure consisting of curved steel girders would be supported by three channel piers founded on piles or on tremie concrete subfootings. The existing bridge piers will be removed to the bottom of the Channel.

The straight alignment extends north from the existing Chelsea Street embankment, passing under the Tobin Bridge. The new bridge will provide for a 75-foot wide boat channel with a minimum underclearance of 10 feet above mean high water (elevation 10.23 Boston base) in accordance with Coast Guard requirements. After the bridge passes over the boat channel, it will descend at a 3% vertical grade to a channelized intersection with Terminal Street. The bridge superstructure will consist of butted prestressed concrete boxes to minimize depth. The roadway cross section configuration will be the same as the curved alignment.

CONSTRUCTION

A curved bridge would require an estimated construction period of 20 to 24 months, with construction costs ranging from \$2.22 million for a two-lane facility to \$2.60 million for a four-lane facility.

A straight bridge would require an estimated construction period of 18 to 20 months with construction costs ranging from \$1.40 million for a two-lane facility to \$1.62 million for a four-lane facility. Please refer to Appendix C for construction phasing and cost breakdowns.

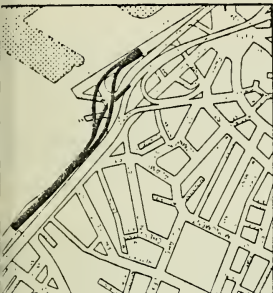


4.D. Alternative 2

ALIGNMENT

In Alternative 2, the four-lane Chelsea-Water Street connector would begin in the south on Water Street near Joiner Street. The northbound and southbound roadways would then split in the vicinity of Gray Street to accommodate the artery off-ramp, and reconverge just south and west of the Commandant's house. (see plates 2, 2P)

The exit from the bridge approach would be located at the present Water Street off-ramp. The off-ramp would pass under the southbound connector roadway and would proceed north, merging with the northbound connector roadway. No provision is made for an expressway exit southbound to City Square. This destination would be reached by making a U-turn via Vine Street and Lowney Way or by Medford Street and return on the southbound connector.



The bridge carrying the southbound connector over the artery off-ramp would be a span of approximately 120 feet. For safety and sight distance the abutments would be set back from the edge of roadway. The bridge would provide a minimum of 14-foot 6-inch vertical clearance.

The inclusion of a ramp bridge in this alternative will require embankments up to 24' high along Ramp A. Ramps B and C will generally follow existing grade with nominal excavation and embankment.

Retaining walls would be required along the east edge of the connector adjacent to the bridge approach supporting columns and between Ramp A and Ramp C south of the Commandant's house. This land is eligible for 4(F) protection.

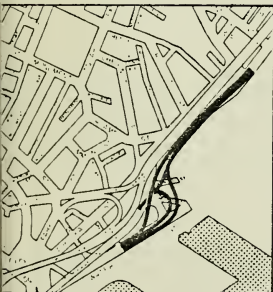
CONSTRUCTION

Alternative 2 would take 18 to 24 months to construct. The connector, link, and ramp modifications would cost an estimated \$1.69 million. A curved bridge over the Little Mystic would cost an estimated \$2.22 million for a 2-lane facility and \$2.60 million for a 4-lane crossing; a straight bridge would cost \$1.40 million for a 2-lane crossing and \$1.62 million for a 4-lane crossing. Total estimated cost with a curved bridge would vary from \$3.91 million to \$4.29 million. Total estimated cost with a straight bridge would vary from \$3.09 million to \$3.31 million.

Details of minor utility relocations, recommended construction sequence, and cost estimate breakdowns are provided in Appendix C.

E. Alternative 2A

ALIGNMENT



This scheme is identical to Scheme 2 (see Plates 2, 2A) but includes an artery off-ramp which splits into a ramp to the northbound connector and a southbound ramp to Water Street toward City Square.

CONSTRUCTION

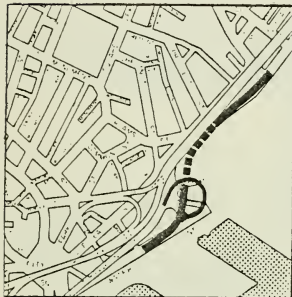
Alternative 2A would take 18 to 24 months to build; the connector, link, and ramp modifications would cost an estimated \$1.76 million. Bridge costs would vary as for Alternative 2. Thus, total estimated project costs would vary from \$2.22 million to \$4.36 million with a curved bridge and from \$3.16 million to \$3.38 million with a straight bridge.

Details of minor utility relocations, recommended construction sequence, and cost estimate breakdowns are provided in Appendix C.

4.F. Alternative 3

ALIGNMENT

This scheme incorporates a tunneled, four-lane Chelsea/Water Street connector with the bridge over the Little Mystic (see Plates 3, 3P). The 600-foot tunnel would begin in the vicinity of Henley Street just outside Gate 2 and would extend just north and west of the Commandant's house. The proper tunnel construction would be cut and cover and would require use of National Park land for construction. The land used could be returned for park purposes when construction is completed.



The tunnel profile is low enough so that the park land may be restored over the roof of the tunnel. This requirement forces the tunnel profile to be below high tide elevation (10.23 feet MHW, Boston base); therefore, the tunnel would have to be of a boat section--that is, the weight of tunnel would have to be sufficient to resist hydrostatic uplift. The tunnel would have a permanent pumping system and lighting. Standby ventilation may or may not be necessary. A construction easement would be required for the cut and cover tunnel construction.

The bridge approach off-ramp would be located just north of the present Water Street off-ramp. The ramp would turn to the right and cross over the tunnel portal. The ramp would make a 270-degree turn and intersect with the connector 3 feet south of the tunnel entrance. This signalized intersection would provide access to both the north and south on the connector.

The roof of the tunnel will be open for 150 feet north of the bridge approach off-ramp and south of the Shipyard wall in order to reduce tunnel costs and to assist in ventilation.

Because the tunnel must be at least 20 feet below the park behind the Commandant's quarters, the tunnel profile rising from this point will necessitate a cut section with minor walls or sloping grade in the vicinity of Gate 4.

The tunnel construction will necessitate underpinning of several of the steel bents supporting the artery. Bents B-7 and B-8 could be either shortened or supported on the roof of the tunnel. There is also the possibility of having to underpin the Commandant's house. The link or portion of Chelsea Street between the tunnel and the bridge will be rebuilt as in Scheme 2.

CONSTRUCTION

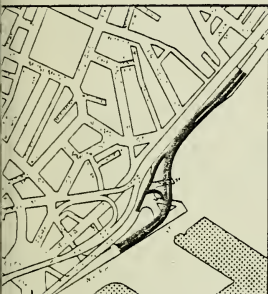
Construction of Alternative 3 would take approximately 24 to 30 months. Costs of the tunnel, link, and ramp approach modifications are estimated at \$7.43 million. Bridge costs would vary as for Alternative 2. Thus, total estimated project costs range from \$9.65 million to \$10.03 million with a curved bridge and from \$8.83 million to \$9.05 million with straight bridge.

Details of the major utility relocations required, recommended construction sequence, and cost estimate breakdowns are provided in Appendix C.

G. Alternative 4

ALIGNMENT

In Alternative 4, the four-lane Chelsea/Water Street Connector would begin in the south on Water Street near Gray Street. It would then proceed towards Gate 1 and then through a reverse curve alignment, proceed through the southwest corner of the Shipyard and then parallel the Tobin Bridge behind the Commandant's quarters (see Plates 4, 4P).



Traffic exiting off the Central Artery would have access to both the north and south via the connector. Southbound traffic to City Square would exit from the Artery on a curved off-ramp which would be located approximately 100 feet north of the present Water Street off-ramp.

Northbound traffic will use the same artery exit, but will continue via a separate ramp that will parallel the Tobin Bridge. This 300-foot long ramp will then join the connector with a signalized intersection.

The connector for most of its length will have two 24-foot roadways separated by a six-foot median. A six-foot sidewalk will be provided along the east side of the connector.

Approximately 400 feet of Shipyard wall will have to be removed and reconstructed along the east side of the connector.

Profiles for this alternative will generally follow existing grade, thereby eliminating retaining walls, a ramp bridge and significant excavation or embankment.

The link or portion of Chelsea Street between the connector and the bridge will be rebuilt as in the other alternatives.

CONSTRUCTION

Construction of Alternative 4 would take approximately 12 to 18 months. Estimated costs of connector, link, and ramp modifications are \$1.19 million. Bridge costs would vary as with the other alternatives. Thus, total estimated project costs would vary from \$3.41 million to \$3.79 million with a curved bridge; from \$2.59 million to \$2.81 million with a straight bridge.

Details of minor utility adjustments, recommended construction sequence, and cost estimate breakdowns can be found in Appendix C.

4.H. Traffic Patterns and Routes

The No-Build does not change existing traffic patterns.

Build Alternatives 2, 2A, 3 and 4 have very similar traffic service characteristics; they would establish a new arterial crosstown route in Charlestown, in effect taking the place of the relatively low capacity, circuitous Chelsea/Lowney Way crosstown route. Each one would tie directly into the Water Street Bridge approach off-ramp and connect via Chamber, Front and Joiner Streets to City Square, the Charlestown Bridge, Rutherford Avenue, the Expressway on-ramp at Park Street and the Tobin Bridge off-ramp at Henley Street. With this configuration, the new street would provide a superior crosstown connection to serve both the planned land uses at the National Park and Shipyard and the Charlestown residential community. The most important effects on trip patterns can be summarized as follows:

- Expressway trips to the Park, the Shipyard, Moran Terminal and the Bunker Hill Street/Medford Street residential area would be diverted from the present Water Street, Gray Street, Chelsea Street, Lowney Way, Bunker Hill Street, Chelsea Street route to the new Chelsea/Water Street link (and the Little Mystic Bridge for Moran trips).
- Surface street trips to and from the City Square distribution point would also be diverted from the Chelsea, Lowney Way, Bunker Hill Street route to the Chelsea/Water link.
- Expressway and surface street trips from the Moran Terminal area to the City Square distribution point would be diverted from the present Terminal Street/Medford Street/Lowney Way route to the new Little Mystic Bridge and the Chelsea/Water link.

Alternative 2, which does not have a return movement to City Square, would also result in a diversion of those trips destined for the Town Hill area, City Square, and Community College, to the Charlestown Bridge.

4.I. Capacity

The No-Build configuration would freeze traffic capacity at approximately the existing levels. Changes could be made to the traffic control devices at key intersections, but the capacity increases resulting would be minimal and the practical capacity for the Lowney Way/Chelsea Street corridor would be approximately 2½ to 3 times the present volume or about 1,000 vehicles per hour. This capacity level could only be attained with a correspondingly low level of traffic service, i.e., much congestion and delay, which would force motorists and truckers to seek new route also located in residential areas.

The proposed Water/Chelsea connector and the Little Mystic Bridge will add substantial capacity to the Charlestown arterial street system. The exact capacity of this four-

lane street would depend upon design and operating details and would be between 2,000 and 4,000 vehicles per hour. Some of the variables which would affect it are:

- the direction of traffic flow;
- the number, location and design of access points;
- the volume of pedestrian crossings;
- the number and width of lanes;
- the curb parking conditions.

Of the four Alternatives, 2 and 2A would have the highest capacity since both involve grade separated roadways and free-flowing designs. Alternative 3 (the tunnel scheme) involves signalizing the end of the ramp and would result in a lower capacity level, although it may be possible to design the major movements with a merge instead of a stop. The at-grade Alternative 4 would have the lowest capacity since the major movements would all be signalized.

Alternatives 2, 2A, and 3 represent a maximum investment strategy designed to accommodate traffic demand generated by complete development of the National Park, Moran Terminal and Shipyard facilities by 1995.

By contrast, Alternative 4 reflects an expectation of less than full development of Shipyard facilities by 1995. It can accommodate Shipyard traffic demand up to 50% of the total 1995 development potential at a good level of service. Thus, it provides the opportunity to respond to further Shipyard development, other highway improvement projects, and/or unchanged traffic demands with maximum flexibility because it involves the lowest initial capital investment.

Anticipated Impacts of the Alternatives

Each discussion of an impact category begins with a statement of which specific impacts will be evaluated and consists of a description of the methodology and criteria used to evaluate impacts followed by their application to existing conditions and to the No-Build and Build Alternatives. The detailed technical aspects of methodology and analysis are published in separate appendices.

A. Transportation Impacts

Transportation impacts are evaluated in terms of traffic service, truck traffic, traffic safety, parking characteristics in the 1975, 1985, and 1995 design years.

5.A.1. Methodology

The basic approach to evaluating transportation service impacts has been to estimate traffic demand in the design year, distribute it over the Charlestown street network including the alternative under consideration, and then to determine probable levels of service, safety, and other characteristics by comparing demand to capacity along affected network links. The evaluations are based on the PM peak hour as the worst case. The specific methodology used has been reviewed and approved by BRA, MassPort, and MDPW; see Appendix D for details.

TRAFFIC DEMAND PROJECTIONS

Existing traffic demand in the study area consists of some local and through traffic generated primarily by current land uses such as the Moran Terminal. In the future, planned growth of the National Park and Moran Terminal as well as redevelopment of the northern Shipyard will generate substantially increased traffic demand. Since full re-use of the Shipyard would account for 75% of projected 1995 traffic volumes, its traffic demand has been included to provide a conservative, worst-case estimate of impacts.

The contribution of other modes of transportation to reducing traffic demand are relatively small. Existing public transit service to the study area is limited to two bus lines linking Sullivan and Haymarket Squares. Direct transit is not a viable alternative to the proposed improvements because it would be neither economical nor capable of serving truck traffic on Lowney Way and Medford Street.

At the same time, it should be recognized that upgraded bus service to the study area would be a valuable asset from a

developmental standpoint and would reduce the number of automobiles, noise, air pollution and pedestrian-vehicular conflicts. As redevelopment progresses, better bus service to this expanded market will become more feasible from an economic standpoint.

Usage estimates were prepared for the National Park (1985, 1995) and the Moran Terminal Expansion (ultimate planned development). Usage estimates for the redevelopment of the Shipyard were prepared in Land Use & Transportation Study: Boston Naval Shipyard, BRA & EDIC, 1975.

Demand projections are based on a moderate usage of bus service and bus connection to rail rapid transit at the Community College station of the Orange Line. Transit patronage was estimated to involve 10-30% of arrivals/departures depending on the particular land-use, based upon existing transit usage levels for comparable facilities in the Boston area. The following volumes are predicted:

Table 5.A-1 Major Traffic Generators (PM Peak Hour)

	<u>1975</u>	<u>1985</u>	<u>1995</u>
Moran Terminal	50	70	70
National Park Visitors	0	200	200
Shipyard Redevelopment	0	0	1850
	<u>50</u>	<u>270</u>	<u>2120</u>

Directions of approach were estimated from prior analyses of population, employment and other factors*. The final step in the projections was the assignment of traffic to the network and the modification of the volumes due to diverted movements in the Build Alternatives. The resulting projections for the year 1995 appear in Figures 5b and 5c.

TRAFFIC SERVICE CRITERIA

A capacity analysis was performed for critical locations in the Charlestown street network for each Alternative using ITE level of service definitions from A (unrestricted flow) to F (stop & go). This analysis was supplemented by a qualitative evaluation of such characteristics as availability and location of turning movements. Where signalization was required, its phasing followed ITE Handbook recommendations equivalent to level of service C.

5.A.2. Traffic Service Impacts

EXISTING CONDITIONS

Existing transportation service characteristics have pre-

*BRA Origin and Destination Survey prepared in March, 1974 assisted in evaluating traffic assignment and diversion to new routes.

viously been discussed in some detail (Chapter 2.E). Figure 5a depicts existing traffic on the Charlestown arterial street system as determined from the records of the city's Traffic and Parking Department supplemented by counts supplied by the Boston Redevelopment Authority.

NO-BUILD ALTERNATIVE

Traffic projections for this alternative are summarized in Table 5.A-2 below (see also Figures 5b and 5c for graphic representations). 1985 projections assume full implementation of Moran Terminal expansion and National Park plans. 1995 projections* assume, in addition, full redevelopment of northern Shipyard facilities:

Table 5.A-2 No-Build Traffic Demand Projections
(PM Peak Hour)

	<u>1975</u>	<u>1985</u>	<u>1995*</u>
Medford Street	440	510	600
Chelsea @ Medford	470	785	2465
Lowney Way	450	725	2310
Chelsea @ Joiner	860	945	1710
Joiner	520	640	1000
Water St. Ramp	225	235	595
C'town Bridge	2420	2465	2855
Tobin Bridge	5490	5515	5705

Traffic Pattern: By keeping the existing street pattern, the No-Build effectively freezes traffic capacity at approximately the existing levels.

Capacity: Projected 1985 volumes under the No-Build present further exacerbation of existing problems with traffic on residential streets such as Lowney Way and Medford Street. Projected 1995 traffic in the Chelsea Street/Lowney Way corridor exceeds its 1,200 vehicle capacity by a factor of more than 2. This capacity level could only be attained with a correspondingly low level of traffic service, i.e., much congestion and delay, which would force motorists and truckers to seek new routes intruding further into residential areas.

Changes could be made to the traffic control devices at key intersections, but the resulting capacity increases would be minimal.

Any redevelopment of the Shipyard would lead to overflow demand, further traffic intrusions into residential areas, and to longer peak periods than now exist. While the order-of-magnitude lack of capacity would almost certainly prove a deterrent to extensive redevelopment, the Shipyard's

*Should redevelopment in the northern Shipyard not occur, 1985 projections provide a guide to probable demand.

advantageous location near the city core and waterfront suggests development pressure. The No-Build alternative would therefore be a bad bargain for serving residential or commercial/industrial purposes.

BUILD ALTERNATIVES

Traffic demand projections for alternatives 2, 2A, 3 and 4 are summarized below in Table 5.A-3 (see also Figures 5b and 5c for graphic representations). 1985 projections assume full implementation of Moran Terminal Expansion and National Park plans and 1995 projections add full redevelopment of Shipyard facilities; in both design years, traffic is distributed on the new street system.

Table 5.A-3 Build Alternatives Traffic Demand Projections
(PM Peak Hour)

	1975	1985	1995*
Medford	440	340	525
Chelsea @ Medford	470	775	2510
Lowney Way	450	185	185
Chelsea @ Joiner	860	850	1205
Joiner	520	485	895
Water St. Ramp	225	220	580
C'town Bridge	2420	2445	2835
Tobin Bridge	5490	5540	5730

Traffic Pattern: Build Alternatives 2, 2A, 3 and 4 establish a new arterial crosstown route in Charlestown, in effect taking the place of the relatively low capacity, circuitous Chelsea/Lowney Way crosstown route. Each one would tie directly into the Water Street Bridge approach off-ramp and connect via Chamber, Front and Joiner Streets to City Square, the Charlestown Bridge, Rutherford Avenue, the Expressway on-ramp at Park Street and the Tobin Bridge off-ramp at Henley Street. With this configuration, the new street would provide a superior crosstown connection to serve both the planned land uses at the National Park and Shipyard and the Charlestown residential community. The most important effects on trip patterns can be summarized as follows:

- Expressway trips to the Park, the Shipyard, Moran Terminal and the Bunker Hill Street/Medford Street residential area would be diverted from the present Water Street, Gray Street, Chelsea Street, Lowney Way, Bunker Hill Street, Chelsea Street route to the new Chelsea/Water Street link (and the Little Mystic Bridge for Moran trips).
- Surface street trips to and from the City Square distribution point would also be diverted from the Chelsea, Lowney Way, Bunker Hill Street route to the Chelsea/Water link.

*Should redevelopment of the northern Shipyard not occur, 1985 projections provide a guide to probable demand.



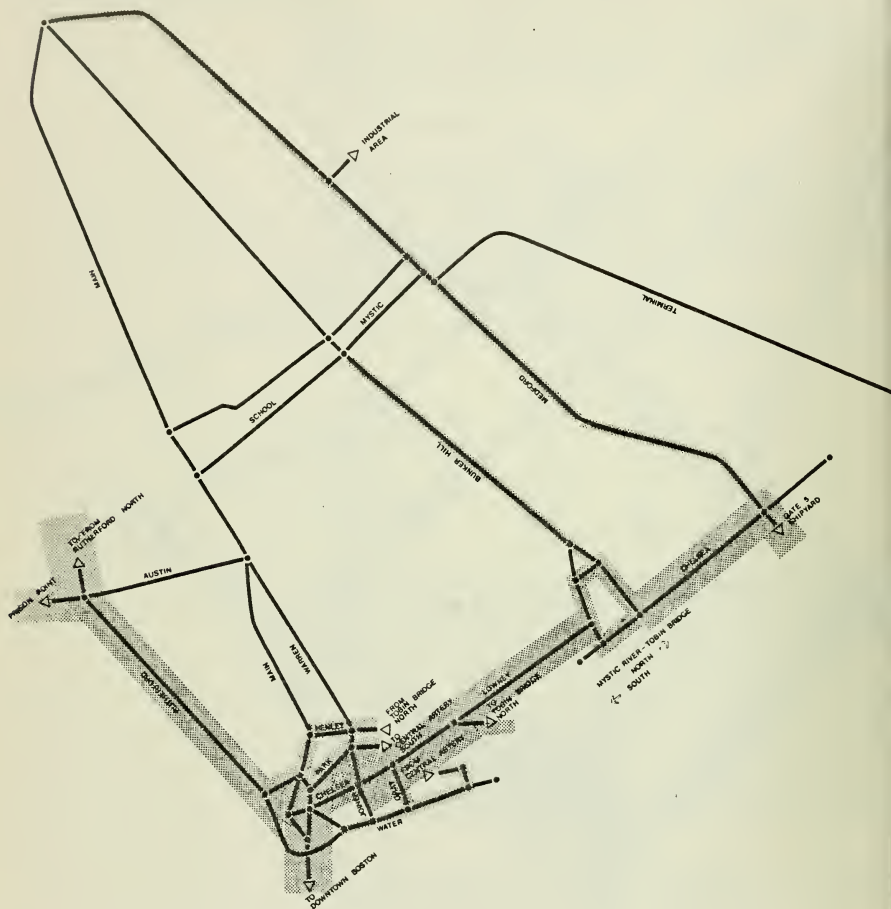
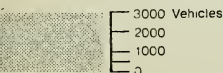


Figure 5b

PM Rush Hour Projected Traffic Flow No Build 1985

Chelsea-Water Streets Connector - Little Mystic Channel Crossing
Draft Negative Declaration





PM Rush Hour Projected Traffic Flow Build Alternatives 1995

Chelsea-Water Streets Connector • Little Mystic Channel Crossing

Draft Negative Declaration



-Expressway and surface street trips from the Moran Terminal area to the City Square distribution point would be diverted from the present Terminal Street/Medford Street/Lowney Way route to the new Little Mystic Bridge and the Chelsea/Water link.

Alternative 2, which does not have a return movement to City Square, would also result in a diversion of those trips destined for the Town Hill area, City Square, and Community College, to the Charlestown Bridge.

In summary, the connection of Chelsea and Water Streets together with the Little Mystic Channel Bridge improve traffic service for both local users of Lowney Way and head through traffic from the major generators.

Capacity: While the Build Alternatives can each carry projected 1995 volumes, they do not do so at the same level of service nor do they all provide the same range of possible movements.

-The capacity of Alternatives 2, 2A, and 3 is controlled by a signalized intersection at Vine Street/Chelsea Street. During the 1995 PM peak hour, this intersection would function at level of service B.

-Alternative 2 does not provide a movement to City Square from the Bridge approach ramp and therefore offers somewhat less traffic service than 2A. The difference represents only 8% of projected 1995 total ramp traffic.

-Alternative 3 and 4 allow all desired movements.

-The capacity of Alternative 4 is controlled by a signalized intersection between the Tobin Bridge approach off-ramp and the Chelsea/Water connector. In order to minimize the possibility of backups on the Bridge approach, these signals would have to favor ramp traffic. As a result, this intersection would function adequately until approximately 1000 vehicles attempt to use it during the AM rush hour; this point will be reached when Shipyard redevelopment is 30-35% complete.

Of the four Alternatives, 2 and 2A would have the highest capacity since both involve grade separated roadways and free-flowing designs. Alternative 3 (the tunnel scheme) involves signalizing the end of the ramp and would result in lower capacity, although it may be possible to design the major movements with a merge instead of a stop. The at-grade Alternative 4 would have the lowest capacity since the major movements would all be signalized.

Comparison of projected traffic peak-hour volumes on Lowney Way and Medford Street reveals major differences between the No-Build and Build Alternatives as shown in Table 5.A-below.

Table 5.A-4 No-Build/Build Volume Comparisons

	1975		1985		1995
	<u>Exist.</u>	<u>1</u>	<u>2,2A,3,4</u>	<u>1</u>	<u>2,2A,3,4</u>
Medford Street	440	510	340	600	525
Lowney Way	450	725	185	2310	185

Traffic demand on Lowney Way would be reduced from 2,310 vehicles in the No-Build condition (PM rush hour 1995) to less than 200 vehicles in the Build condition. In effect, Lowney Way would no longer be an arterial collector and would revert to a local street. The decrease in Medford Street traffic, on the order of 75 vehicles, is less dramatic but involves a significant decrease in the numbers of heavy trucks (see 5.A.3: Truck Traffic Impacts).

These impacts are in keeping with design objectives. Alternatives 2, 2A and 3 are intended to provide a bypass from residential areas and to accommodate full development of the Shipyard and other facilities by 1995. Alternative 4 is predicated on relieving residential areas and serving less than full Shipyard redevelopment by 1995. If the traffic demand on the off-ramp intersection begins to approach approximately 1,000 vehicles at the AM peak hour, remedial measures will have to be considered in order to encourage continued Shipyard redevelopment.

5.A.3. Truck Traffic Impacts

The basic criterion of impact is the number of heavy trucks on streets. The fewer their numbers on residential streets, the better. (See fig. 5d for truck routes.)

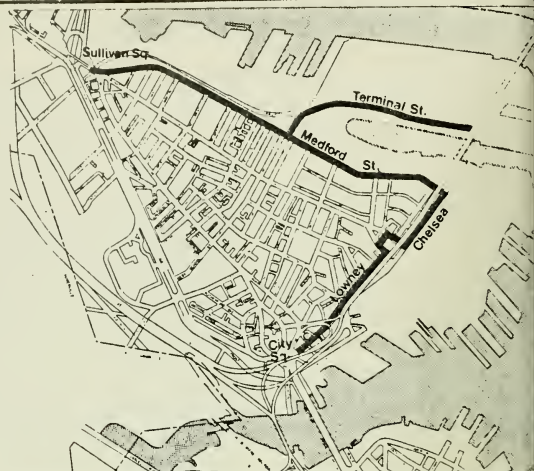
NO BUILD ALTERNATIVE

The No-Build Alternative leaves the present truck problems in Charlestown untreated. The existing use of the Lowney Way/Chelsea Street corridor by trucks would remain. To some destinations, particularly the Shipyard (Gate 5), this would be the only logical access, and thus, a significant increase in truck traffic in this sensitive corridor would undoubtedly occur.

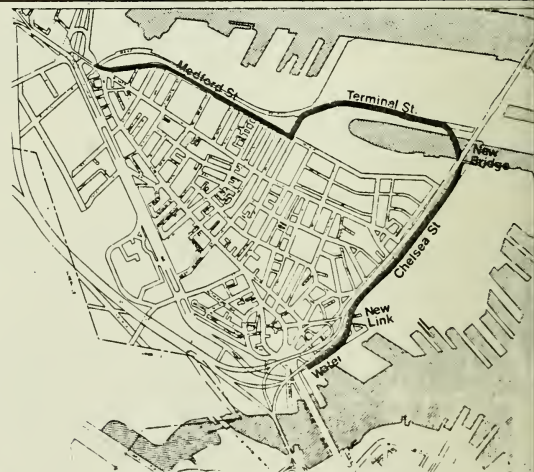
Table 5.A-5 No-Build Truck Traffic Projections
(PM Peak Hour)

	1975	1985	1995*
	<u>Hvy/Other</u>	<u>Hvy/Other</u>	<u>Hvy/Other</u>
Medford Street	21/30=51	26/33=59	26/33=59
Lowney Way	15/34=49	20/37=57	36/97=133

*Assumes full development of Shipyard



Existing



Proposed

Figure 5c

Truck Through-Routes in the Corridor

Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



In 1985 and 1995 the No-Build Alternative implies increased truck traffic on residential streets at all times of day (14% and 63% respectively on Lowney Way).

BUILD ALTERNATIVES

The Build Alternatives would have a pronounced impact upon truck movement patterns in the easterly section of Charles-town. By linking the Artery ramp and City Square directly to the Terminal Street industrial area and the Shipyard, an alternate to the Lowney Way corridor would be available. Since the new route would be more direct, shorter, and quicker, it would divert virtually all of the truck traffic from Lowney Way. The closing of Bunker Hill Street at Chel-sea Street would all but guarantee that Lowney Way would not be used as a through route. The only trucks expected to use Lowney Way would be those servicing the commercial and residential activities along Bunker Hill Street. Med-ford Street would be used chiefly by northern Shipyard trucks.

Truck traffic projections are as follows:

Table 5.A-6 Build Alternatives Truck Traffic Projections
(PM Peak Hour)

	1975	1985	1995*
	<u>Hvy/Other</u>	<u>Hvy/Other</u>	<u>Hvy/Other</u>
Medford Street	21/30=51	7/20=27	7/20=27
Lowney Way	15/34=49	5/11=16	5/11=16

The Build Alternatives substantially reduce the numbers of heavy and light plus medium duty trucks on residential streets. The percentage reductions in heavy truck traffic alone are shown below in Table 5.A-7.

Table 5.A-7 Percent Reduction in Heavy Truck Traffic
Builds vs. No-Build 1985 & 1995 (PM Peak)

	1985	1995
Medford Street	26 to 7:-73%	26 to 7:-73%
Lowney Way	20 to 5:-75%	36 to 5:-86%

The Build Alternatives represent a substantial improvement in conditions on Medford Street and Lowney Way, especially in view of the fact that they involve less truck traffic on these streets than even the 1985 No-Build condition without Shipyard redevelopment.

5.A.4. Traffic Safety Impacts

Perhaps the most significant qualitative findings of prior accident studies is the clear relationship between the num-

*Assumes full development of Shipyard

ber of accidents and the amount of congestion. As traffic density increases so does the number of accidents.

While it is not possible to analytically project the accident potential (of the alternatives), prior studies suggest that the fewer, simpler, and more separated driver decision points are, the safer road alignments are likely to be.

With these findings it is possible to evaluate the safety characteristics of the Alternatives by comparing (1) traffic densities and (2) the number of driver decision points.

NO-BUILD ALTERNATIVE (CRITERION 1)

Given increasing traffic density and the number of decision points on an unchanged street network, a large increase in accidents can be predicted for the No-Build Alternative. The expected intrusion of commuter traffic onto the residential streets would be a serious hazard both to the residents of these areas and the motorists using these streets.

BUILD ALTERNATIVES (CRITERION 1)

Alternatives 2, 2A, and 3 would improve the quality of flow at the bridge approach off-ramp and concurrently raise the level of traffic safety at this key location. Alternative 4 would be less of an improvement, especially if full Shipyard development occurred by 1995. By diverting heavy traffic loads from the narrow and congested residential streets west of the Tobin Bridge to a modern arterial street, the four Build Alternatives, would result in a significantly lower number of traffic accidents for the balance of the arterial system in the community.

NO-BUILD ALTERNATIVE (CRITERION 2)

(Fold out Plate 1) While motorists have only one decision point, the existing bridge approach off-ramp at Water Street is considered to be a hazardous location. Ramp design does not satisfy current design standards.

BUILD ALTERNATIVES (CRITERION 2)

The different design characteristics of the four Build Alternatives suggests they would exhibit different levels of safety improvement over the existing off-ramp configuration.

Alternative 2 (fold out Plate 2) offers the highest level of safety among the Alternatives. The only decision point for motorists is the Tobin Bridge approach and this can easily be signed. The ramp provides a smooth merge with the Chelsea/Water Street connector and requires no signalization.

Alternative 2A (fold out Plate 2A) presents motorists with two decision points within a very short distance; first,

on leaving the Bridge approach and, second, at the beginning of the southbound City Square off-ramp. This would be difficult to sign and could present a problem for motorists not familiar with the area. Should this Alternative be chosen because of other attributes such as the inclusion of the City Square turn, final engineering must give priority to keeping the distance between decision points as long and as visually unobstructed as possible.

Alternative 3 (fold out Plate 3) may require signaling the intersection of the Tobin Bridge approach off-ramp and the Chelsea/Water Street connector; this would present a rear-end collision hazard. However, it may be possible to merge movements without a signal since the ramp can store about 10% of projected peak-hour flow without backing up onto the Bridge approach. In either case, the restricted visibility and tight curvature of the ramp increase the risk of accidents.

Alternative 4 (fold out Plate 4) has a double decision point similar to that of Alternative 2A and requires a traffic signal at the end of the Bridge approach off-ramp. This is potentially a hazardous condition especially if a large number of drivers are unfamiliar with the area or demand exceeds intersection capacity.

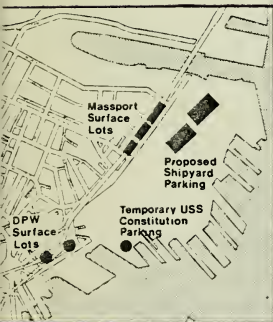
5.A.5. Parking Impacts

The two basic criteria in evaluating parking impacts are (1) the number of available spaces and (2) locational convenience for users.

NO-BUILD ALTERNATIVE

Traffic analysis of the No-Build Alternative has been based on the assumption that on-site parking will be provided in an amount sufficient to accommodate the anticipated demand. Some existing parking east of the bridge approach near Gate 1 and inside the Park boundaries may be lost if Gate 1 should develop into a primary access point to the Park. In either case, the three lots under the Tobin Bridge (between Medford Street and Vine Street) would be reserved for use by National Park visitors. However, the use of Gate 4 for secondary vehicular Park access would be impractical and the actual use of the lots under the Tobin Bridge would probably not develop due to the very long walk involved. This leaves a substantial unsatisfied parking demand which would have to be served inside the Park boundaries or at existing curb spaces. At present, there is parking within the Park boundaries, serving a short-term need. Long range plans are to remove the internal parking from the National Park.

Parking for activities in the northern part of the Shipyard would have to be on site and reached through Gate 5.



BUILD ALTERNATIVES

The four Build Alternatives would provide much improved access to the three proposed parking lots under the Tobin Bridge (to serve the National Park) and would make their use considerably more feasible. By accomplishing this, they would reduce the reliance upon curb parking, and lower the requirements for parking capacity inside the Shipyard and Park boundaries. Since these lots can accommodate about 300 vehicles, the reduced demand for curb spaces could be very substantial despite the fact that these Alternatives prevent curb parking on Chelsea Street and a section of Water Street and take a MDPW parking lot near Gate 1. The latter will not be replaced in this project.

5.A.6. Construction Period

If Shipyard redevelopment begins prior to construction of a Build Alternative, it may be necessary to provide temporarily access to the northern Shipyard and its parking areas through Gate 1 and along 1st and 2nd Avenues in the National Park until the Chelsea/Water Street connection is completed.

3. Air Quality

The air quality analysis evaluated and compared the impacts of the No-Build and Build Alternatives on projected air quality in the study area in 1976, 1985, and 1995. These projections were also compared with Federal and State ambient air quality standards and plans for their attainment and maintenance under the Clean Air Act of 1970.

An analysis of projected emissions was carried out on a local scale for carbon monoxide (CO) and on a regional basis for carbon monoxide, hydrocarbons, and nitrogen oxides. In both instances, the analysis assumed implementation of the Boston Transportation Control Plan and Federal vehicle emission control regulations according to their current time schedules.

Analytic procedures and detailed evaluation are presented in Appendix E.

AIR QUALITY MODELING

Carbon monoxide concentrations resulting from each of the Alternatives were projected using the APRAC-1A urban diffusion model. Motor vehicle emission rates were computed using the subprogram VEHEMI. This model uses an EPA methodology to allow explicit representation of local vehicle mix and incorporates the results of recent studies of vehicle emissions. VEHEMI replaces an empirical equation in APRAC-1A which was previously used for this purpose. The model was calibrated by comparing its predictions for the monitoring period with observed values (see Existing Conditions below).

APRAC-1A requires a traffic data base structured on two levels: (1) a high-resolution primary network in the study area and (2) a grid of area sources for traffic emissions from outside the study area. The first set of inputs came from the geometry of the proposed Alternatives (Chapter 4) and from traffic volume predictions (Chapter 5); the second set of inputs used information developed by EPA and others in preparing the Metropolitan Boston Transportation Control Plan. The following cases* were modeled:

	No-Build	Build Alternatives			
	1	2	2A	3	4
1976	x	x	x	x	x
1985	x	x	x	x	x
1995	x	x	x	x	x

The impacts of the Build Alternatives in 1976 were evaluated for comparison purposes and are reported in Appendix E.

The one-hour and eight-hour maximum CO concentrations were calculated at seven sensitive receptor points for each Alternative in each design year. In each instance, the "worst-worst" case was assumed, i.e., a joint occurrence

*Projected emissions were also calculated for the Build Alternatives with the introduction of the J.F. Kennedy Museum into the Shipyard. See Appendix

of peak traffic and most adverse meteorological conditions.

Because of the extremely localized effects of CO emissions, the seven selected receptor points are primarily located on streets which would experience changes directly attributable to the implementation of an Alternative. These receptor sites, shown in Figure 5c, include:

1. Lexington Street near Monument Square
2. City Square
3. Navy Yard Gate 1
4. Kent School
5. Barry Playground (Chelsea & Medford Streets)
6. Proposed High School (Terminal & Medford Streets)
7. Public Housing (Tufts & Medford Streets)
8. Monitoring Site

No single wind direction simultaneously produces the worst conditions at all receptor sites in a complex urban environment. As a result, the reported emissions projections are composites of the highest values at each site.

CRITERIA

Pursuant to the Clean Air Act, the U.S. Environmental Protection Agency (EPA) promulgated air quality standards for six airborne pollutants on April 13, 1971. These standards are shown in Table 5.B-1. Air quality standards represent maximum pollutant exposures for which no adverse effect to public health (primary standard) or welfare (secondary standard) will occur.

Table 5.B-1: Massachusetts and Federal Air Quality Standards

	Avging. Time	Primary ($\mu\text{g}/\text{m}^3$)	Concentrations		Std. (ppm)	Meas'r'mt. Criteria*
			Std. (ppm)	Sec. ($\mu\text{g}/\text{m}^3$)		
Sulfur Oxides (SO_2)	Year	80	0.03	---	---	Ar. Mean
	Day	365	0.14	---	---	Maximum
	3 Hrs.	---	----	1300	0.5	Maximum
Total Suspended Particulates (TSP)	Year	75	----	60**	---	Geo. Mean
	Day	260	----	150	---	Maximum
Carbon Monoxide (CO)	8 Hrs.	10000	9	10000	9	Maximum
	1 Hr.	40000	35	40000	35	Maximum
Photochemical Oxidants (O_3)	1 Hr.	160	0.08	160	0.08	Maximum
Hydrocarbons (Non-Methane)	3 Hrs.	160***	0.24	160	0.24	Max. bet. 6-9 am
Nitrogen Oxides (NO_2)	Year	100	0.05	100	0.05	Ar. Mean

*Standards other than those based on annual arithmetic or geometric mean are not to be exceeded more than once per year.

**For use as a guide in assessing implementation plans to achieve the 24-hour TSP standard.

***For use as a guide in devising implementation plans to achieve the oxidant standard.

EXISTING CONDITIONS

A 60-day CO monitoring program was undertaken to establish existing CO levels and to calibrate the APRAC-1A urban diffusion model used to project CO concentrations for each of the alternatives. Monitoring equipment was installed within the corridor on the roof of Building 204 of the Boston Naval Shipyard, approximately 40 feet from the Tobin Bridge. Details of test, calibration, data validation, recording, and analytical procedures are provided in Appendix E. See Figure 5e for location of monitoring site.

One-hour and eight-hour CO standards were never exceeded at the site during the monitoring program, as shown in Table 5.B-2 below.

Table 5.B-2 Maximum Measured CO Concentrations (ppm)
September 4, 1975 - November 4, 1975

<u>Averaging Period</u>	<u>Maximum Concentration</u>	<u>Federal & State Standards</u>
1-Hour	10.2	35
Running 8-Hour	5.1	9
Discrete 8-Hour	4.6	9

Statistical analysis of the measured data suggests that no violations of the CO standards occurred at the site during 1975.

CO CONCENTRATION PROJECTIONS

The results of the modeling simulation are given in Table 5.B-3 and Table 5.B-4 and are shown graphically in Figures 5e and 5f below*.

BASE YEAR (1976)

The one-hour CO standard is exceeded only at City Square in 1976. The eight-hour standard is exceeded at all seven receptor sites.

NO BUILD

In 1985 and 1995 no exceedances of the one-hour CO standard will occur. The eight-hour standard will be exceeded in City Square in 1985 and 1995.

BUILD ALTERNATIVES

The one-hour standard is not exceeded in any design year. All Alternatives result in exceedance of the eight-hour standard at City Square in 1985 and 1995.

*Interpolation of CO isopleths is not recommended because of the localized effects of CO emissions.

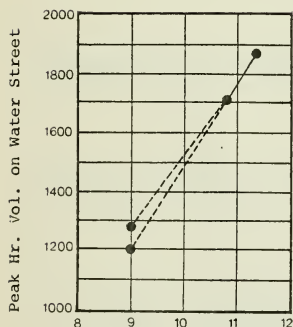
Table 5.B-3: Maximum One-Hour CO Concentrations (ppm)

	Alternative 1			Alt. 2,2A,3		Alternative 4	
	1976	1985	1995	1985	1995	1985	1995
Bunker Hill Mon.	21.5	10.5	11.3	10.5	11.0	10.5	11.0
City Square	51.8*	23.6	23.7	21.9	23.6	21.9	23.6
Kent School	22.5	10.6	12.0	10.5	11.2	10.5	11.5
Navy Yard Gate 1	18.9	9.1	9.4	10.2	14.5	10.9	18.6
Proposed H. School	26.1	13.1	14.0	11.5	12.5	11.5	12.5
Barry Playground	23.9	11.8	12.9	12.4	13.0	12.4	13.0
Housing Project	26.3	13.4	15.0	11.8	13.2	11.8	13.2

Table 5.B-4: Maximum Eight Hour CO Concentrations (ppm)

	Alternative 1			Alt. 2,2A,3		Alternative 4	
	1976	1985	1995	1985	1995	1985	1995
Bunker Hill Mon.	12.4**	6.0	6.5	6.0	6.3	6.0	6.3
City Square	29.8**	13.6**	13.6**	12.6**	13.6**	12.6**	13.6**
Kent School	12.9**	6.1	6.9	6.0	6.4	6.0	6.6
Navy Yard Gate 1	10.9**	5.2	5.4	5.9	8.3	6.3	<8.9***
Proposed H. School	15.0**	7.5	8.0	6.6	7.2	6.6	7.2
Barry Playground	13.7**	6.8	7.4	7.1	7.5	7.1	7.5
Housing Project	15.1**	7.7	8.6	6.8	7.6	6.8	7.6

If any of the Build Alternatives are constructed, CO levels on Medford Street in 1995 will be 12% lower than under the projected No-Build case. CO concentrations in the vicinity of the proposed Chelsea/Water Street connector would be 10 to 50% higher than with the No-Build, but below the maximum permitted levels. CO concentrations at all other receptor sites will not change significantly, i.e., less than 10%.



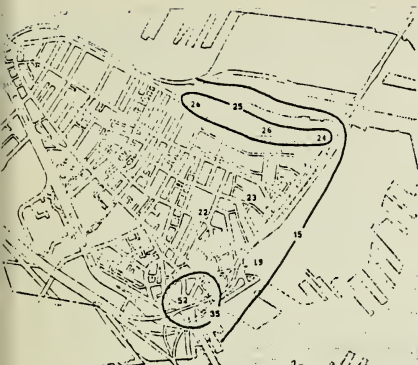
Max. est. 8-hr. CO concentrations in ppm at Gate 1

*Exceeds Mass. and Federal 1 hour standard of 35 ppm.

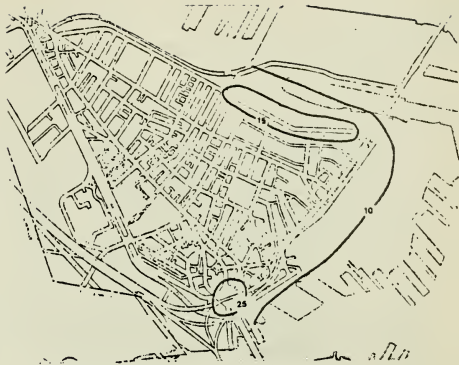
**Exceeds Mass. and Federal 8 hour standard of 9 ppm.

***CO concentrations near Gate 1 are primarily affected by traffic volume on Water Street. The peak hour volume on Water Street is proportional to the volume on the Chelsea-Water Streets connector. In Alt. 4, the practical limit of the connector is reached when approximately 1000 vehicles use it in the peak hour; this is 50% of total projected 1995 traffic, including vehicles generated by redevelopment of 35% of northern Shipyard potential. The associated peak hour volume on Water Street is approximately 800-900 vehicles/hour.

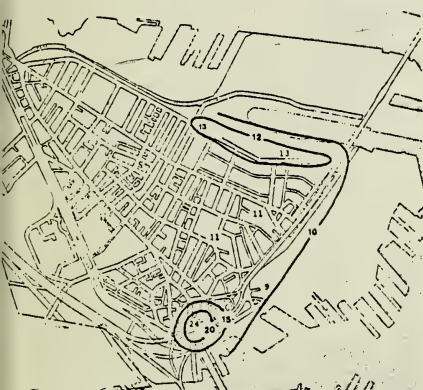
8 hr. CO concentrations near Gate 1 have been modeled using two 1995 projections for Water Street. As shown opposite, a curve can be conservatively extrapolated to show concentrations due to different peak hour volumes. If 8.9 ppm can be achieved with 1200 veh./hr., 800-900 veh./hr. would clearly result in lower 8 hr. CO concentration projections.



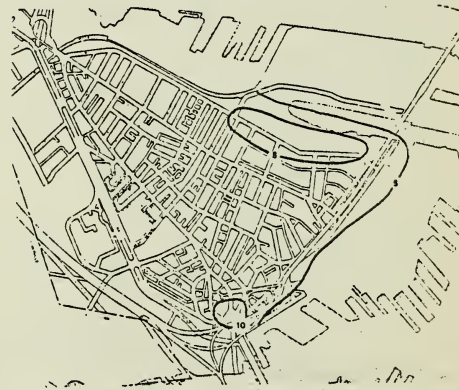
NO-BUILD 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



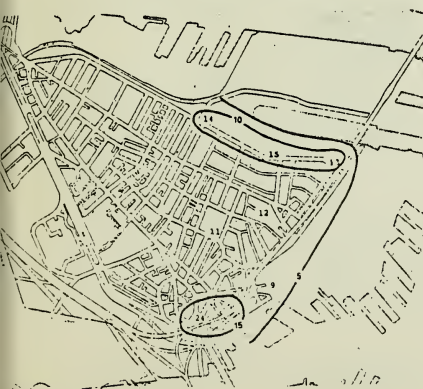
1974 NO-BUILD 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE



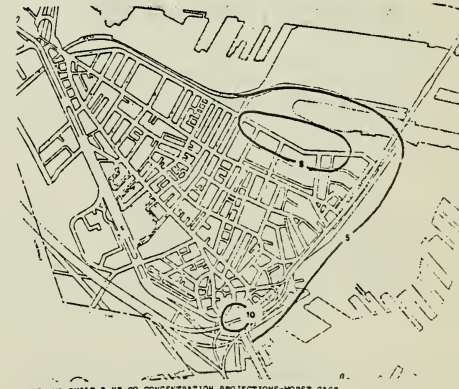
NO-BUILD 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



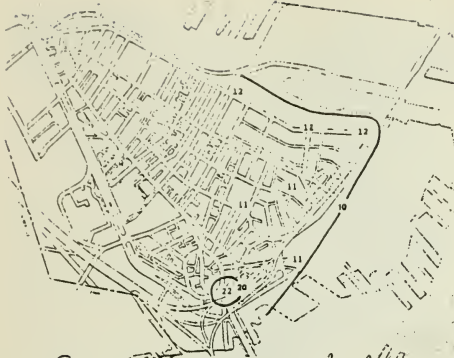
1985 NO-BUILD 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE



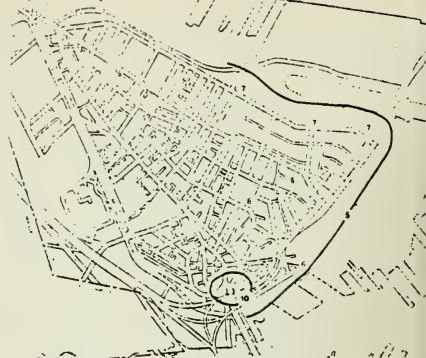
NO-BUILD 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



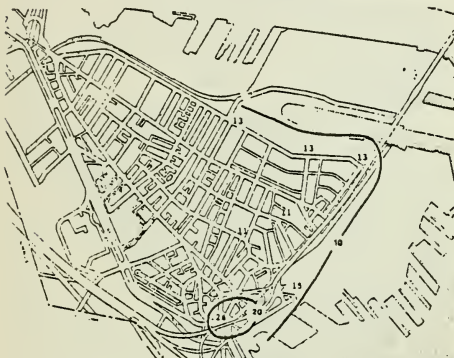
1995 NO-BUILD 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE



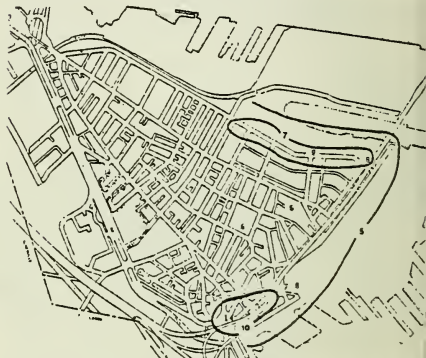
1985 ALTS 2,2A,3,4: 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



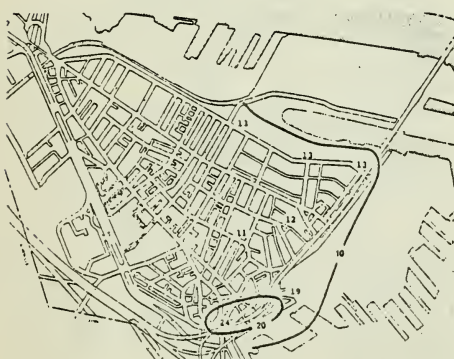
1985 ALTS 2,2A,3,4: 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE



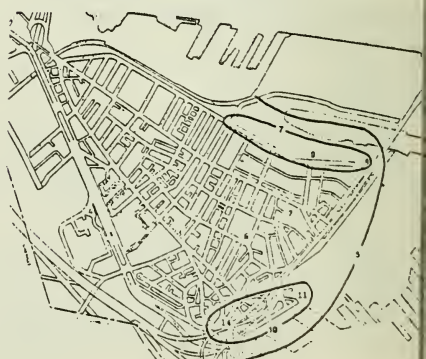
1995 ALTS 2,2A,3: 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



1995 ALTS 2,2A,3: 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE



1995 ALT 4: 1 HR CO CONCENTRATION PROJECTIONS-WORST CASE



1995 ALT 4: 8 HR CO CONCENTRATION PROJECTIONS-WORST CASE

Figure 5f: BUILD ALTERNATIVES 2,2A,3,4 CO CONCENTRATION: WORST CASE PROJECTIONS IN PPM ISOP

OTHER POLLUTANT PROJECTIONS

Estimates of total annual vehicular emissions of CO, HC, and NO_x from the primary link network (see Appendix E) were prepared for each alternative for each design year; results of this analysis are shown in Table 5.B-5. No evaluation of other pollutants, such as photochemical oxidants (O₃), sulfur oxides (SO₂), and total suspended particulates (TSP) was required by EPA.

Vehicle emissions of CO, NO_x, and HC will decrease sharply for all alternatives between 1976 and 1985 because of a shift to emission controlled vehicles and implementation of the Boston Transportation Control Plan. Total annual emissions of these pollutants will then increase somewhat between 1985 and 1995 for all Alternatives as the number of vehicle miles travelled increases.

Build Alternative emissions will be equal to or less than those of the No-Build in 1985 and 1995. In 1995, Alternative 4 will have slightly higher CO emissions than the other Build Alternatives if the Shipyard is fully redeveloped by that year.

Table 5.B-5 CO, HC, and NO_x Emissions in Study Area
(100 tons/year)

	No-Build			Alt. 2,2A,3,4		
	CO	HC	NO _x	CO	HC	NO _x
1976	10.5	1.3	1.0	9.6	1.2	0.9
1985	4.5	0.5	0.4	4.0	0.5	0.4
1995	6.3	0.7	0.5	5.0*	0.6	0.5

EFFECT ON BOSTON TRANSPORTATION CONTROL PLAN

To achieve air quality standards for pollutants emitted primarily by motor vehicles in the Metropolitan Boston area, a Transportation Control Plan (BTCPP) is being put into effect. To be consistent with this Plan, the Build Alternatives must not hinder attainment or maintenance of standards at sites where standards will be met under the No-Build Alternative. In these terms, implementation of any of the Build Alternatives will not hinder attainment or maintenance of CO standards under the BTCPP.

CONCLUSIONS

Air quality, as defined by CO level, in the study area is predicted to improve significantly between 1976 and 1995 for all alternatives. Air quality levels (CO) with the Build Alternatives are predicted to be equal to or less than those levels predicted for the No-Build option at all studied receptor sites.

*Alternative 4 emissions are 5.4 x 100 tons/year if the Shipyard is fully redeveloped by 1995.

5.C. Noise

Noise level criteria, field measurement techniques, and noise impact prediction procedures formally applicable to this study are contained in the Federal Highway Administration's "Procedures for Abatement of Highway Traffic Noise and Construction Noise".⁶

NOISE MEASUREMENT

Noise levels are measured in decibels: dB(A). Since the dB(A) scale is logarithmic, changes in dB(A) levels do not follow simple arithmetical relationships. For example, the 60 dB(A) level typical of normal conversation at 3 ft. is approximately eight times louder than the 30 dB(A) ambient background noise on a calm day in rural areas. The following relationships provide a guide to the significance of changes in dB(A) levels:

+ 2-3 dB(A) barely noticeable in urban conditions

+ 5-6 dB(A) noticeable change

+ 10 dB(A) doubling/halving of loudness

Thus, other things being equal, a change of 2 dB(A), say from 70 dB(A) to 72 dB(A) or to 68 dB(A) is not particularly noticeable except under laboratory conditions.

CRITERIA

FHWA noise criteria specify various design noise level limits for highway noise during the noisiest traffic hour in areas occupied or used by people. The outdoor noise limit is $L_{10} = 70$ dB(A)* for virtually all types of land use except especially quiet parks [60 dB(A)]. The $L_{10} = 70$ dB(A) criterion applies to most of the existing and planned land uses in the project area. Industrialized land areas have a 75 dB(A) limit. Violations of the criteria require consideration of methods for reducing the highway noise to meet the criteria.

METHODOLOGY

Existing ambient noise levels were measured in L_{10} dB(A) at a number of sites typical of conditions in the study area. These values were then compared to future noise level predictions for each alternative in 1985 and 1995. Predictions using an FHWA approved method were based on peak hour volume projections presented in Ch.5.A. A detailed discussion of field measurement techniques and noise level prediction procedures can be found in Appendix F.

* L_{10} refers to that dB(A) level which is only exceeded 10% of the time.

AMBIENT NOISE LEVELS

In the northeastern section of Charlestown, noise comes from two sources; the steady portion is due to the presence of many distant sources, principally motor vehicles in and around Charlestown, and a fluctuating portion is due to nearby sources such as traffic, aircraft flyovers, construction, voices and other street activity. The most obvious source of noise in the study area is the considerable truck and automobile traffic on the double decked Tobin Bridge. Its acoustical influence extends 200 to 500 feet out on each side of the bridge. The noise and its source are most obvious north of the Kent School area where the bridge is elevated well above the surrounding buildings.

Eighteen sensitive receptor sites were chosen for field measurement of existing ambient noise levels; some of these sites were previously studied in 1972. Results of the L_{10} and L_{50} dB(A) measurement program are shown in table 5C-1 below.

Since the traffic volumes and other urban commercial activities remain reasonably uniform throughout the day, the noise level is found to be nearly constant from about 7 a.m. to 5:30 p.m. on each weekday.

At most urban sites noise is dominated by trucks; hence noise on weekends, holidays and between the evening and morning rush hour will be considerably less. Nighttime noise levels in residential areas were not measured for the current study, however, previous data indicate a decrease of about 10 to 12 dB for areas far (over 500 ft.) from major highways and 4 to 8 dB for areas closer to such highways. The minimum noise level occurs in the early morning hours, between 1 and 4 a.m.

A small but highly probable decrease in the measured ambient noise was found between 1972 and 1975. For those sites near the Tobin Bridge ramps where bridge traffic noise predominates, there is an average drop of 3 dB reflecting a significant reduction in overall traffic, particularly trucks during the busiest daytime hours. Traffic flow data for these two years indicate an ADT reduction from about 77 to 66 thousand for an average weekday. Although this change in daily volume alone could not account for the observed reduction, the remaining noise level drop may be due to a relatively greater decrease in noisy types of trucks operating during the peak traffic hours. This latter fact could not be confirmed.

NOISE LEVEL PROJECTIONS

Future noise levels at a particular spot depend on whether local street traffic, especially heavy trucks, constitutes the principal noise source and, if so, by how much it ex-

Table 5C-1 Measured Noise Levels

	Year	Principal Sources	Measured dB(A)	
			L ₁₀	L ₅₀
Water St./Foss St.	'72	HW, L	75	69
Off Ramp/Wapping St.	'72	HW	74	67
*	'75	HW	71	69
Shipyard - Bldg. 24	'75	Yard Activities	70	64
Shipyard - Commandant's house	'75	HW	69	66
Shipyard - Gate 5/5th Ave.	'75	HW	71	68
YMCA/City Square	'72	L, HW	76	70
On/Off Ramp/Henley St.	'72	HW, L	84	75
Winthrop Sq./Adams St.	'72	L, HW	73	66
58 Chestnut St.	'72	L	64	58
Prospect St./Edgeworth St.	'72	HW, C, L	66	63.5
*	'75	HW, L	66	64
Lowney Way/Tremont St.	'72	HW, L	81	75
*	'75	HW, L	77	73
Monument Sq./Tremont St.	'72	L, C	63.5	58
*	'75	L, C	62	56.5
Bunker Hill St./Tufts St.	'72	L	72	68
Vine St./Hunter St.	'72	HW, L	75	70
*	'75	HW, L	72	69
Barry Playground	'75	HW	70	68
Medford St./High School Site	'75	L	70	64

* = Comparison site to test validity of 1972 data for 1975 conditions

HW = Limited Access Highway and Ramp

L = Local Street

C = Children

Table 5C-2 Receptor Noise Level Predictions by Alternative (L₁₀ dB(A))

	1975		1985		1995	
	Exist.	1	2,2A,3,4	1	2,2A,3,4	
1. Shipyard Gate 1	*	69	70,72,73,73	70	73,76,78,79	
2. Shipyard Building 24	70	62	62 ²	63 ²	63 ²	
3. Shipyard Com. house ³	69	74	75	74	75,75,75,77	
4. Shipyard 4th Ave. @ 9th St.	*	71	71 ²	71 ²	72 ²	
5. Shipyard 5th Ave. @ Gate 5	71	70	70 ²	70 ²	70 ²	
6. Lowney Way @ Tremont	81	79	78	82	78	
7. Prospect St. @ Edgeworth	66	66	66	67	66	
8. Kent School (New)	*	77	74	78	74	
9. Decatur St. @ S. Morse Way	*	75	75	75	76	
10. Barry Playground	70	72	72	72	72	
11. Medford St. @ Tufts	*	77	73	77	73	
12. Medford St. @ High School	70	77	73	77	73	
13. Bunker Hill St. @ Lexington	*	77	74	77	74	
14. Monument Sq. @ Tremont	62	68.5 ¹	68.5 ¹	69 ¹	69 ¹	
15. Winthrop Sq. @ Adams	73	68.5 ¹	68.5 ¹	69 ¹	69 ¹	
16. City Square	76	87	87	87	87	

1. Estimated value used for lack of local street traffic data

2. Does not include effects of traffic within Shipyard.

* No field data obtained.

ceeds all other combined sources. Significant reductions in traffic generated noise levels may be possible for areas outside the Tobin Bridge's region of influence.

L_{10} dB(A) projections have been prepared for sixteen specific sensitive receptors. These receptors are distributed at various distances from the Tobin Bridge as well as at isolated critical points such as residential areas or community facilities.

Recent EPA studies (cited in Appendix F) indicate that average levels of urban noise can be characterized reasonably accurately on the basis of population density alone. Such values have been computed for the Charlestown study area and are as follows:

<u>Year</u>	<u>Population</u>	<u>Mean Noise Level [L_{10} dB(A)]</u>
1975	17,500	68 $\pm$ 6
1985	20,000	68.5 $\pm$ 6
1995	22,500	69 $\pm$ 6

This range of values agrees closely with the range of ambient noise levels obtained by field measurement and have been used where local traffic data is not available.

Results of this analysis are graphically shown for all alternatives in fig. 5g and presented in comparative format in table 5C-2.

5.A.1. Noise Level Prediction

NO-BUILD ALTERNATIVES

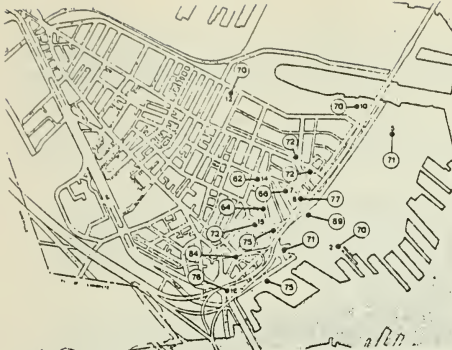
1985 - Noise levels are unchanged because truck traffic increases only slightly compared to 1975.

1995 - The anticipated intensive utilization of the Shipyard will increase the truck volumes on Lowney Way and the BHA playground loop with a corresponding small increase of 1 to 3 dB in noise along this route compared to 1975/85.

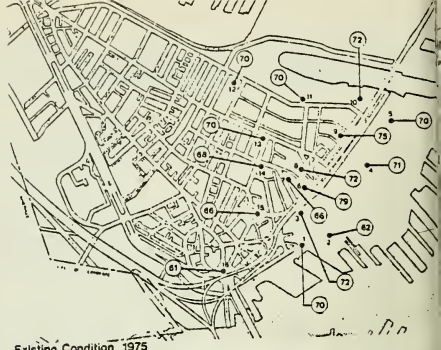
BUILD ALTERNATIVES

1985 - Diversion of trucks from Lowney Way and the loop around the BHA playground will offer up to 3 dB noise reduction in adjacent areas such as the Kent School. Noise along eastern Medford Street will also drop 4 dB relative to no-build condition as a result of fewer anticipated trucks. Traffic volumes across the new Little Mystic Bridge are in all cases too low to affect any of the receptors selected for analysis.

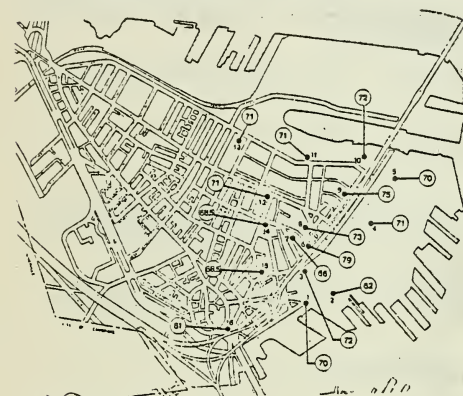
1995 - Virtually no significant increases in noise levels are anticipated in the residential areas since local car and truck traffic volumes are expected to remain nearly



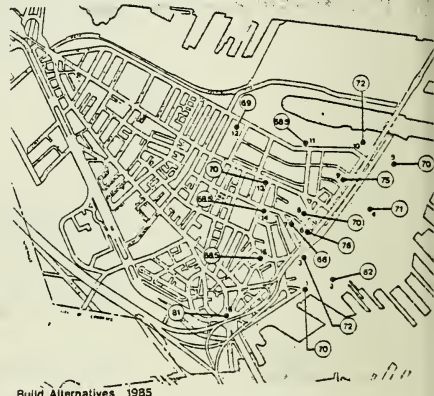
AMBIENT NOISE SURVEY



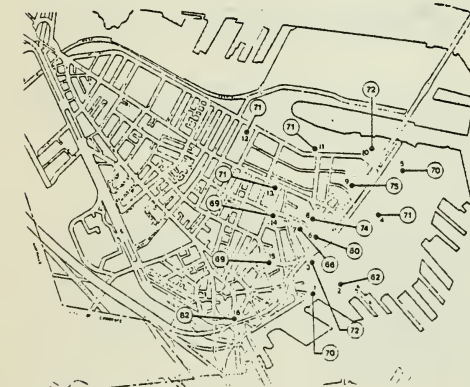
Existing Condition 1975



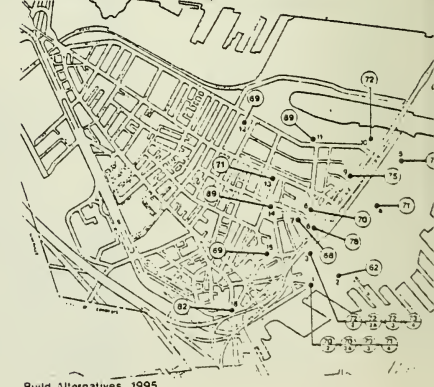
No Build Alternative 1985



Build Alternatives 1985



No Build Alternative 1995



Build Alternatives 1995

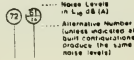


Fig. 5h
CALCULATED PEAK HOUR
TRAFFIC NOISE

Chesapeake Water Streets Comm.
Little Mystic Channel Cross

the same as in 1985. The increased traffic to and from the Shipyard will contain a relatively small proportion of trucks, hence noise in the areas directly adjacent to the Water Street to Chelsea Street connector will not change very much. Except for Alternative 4, which displays stop and go traffic, Tobin Bridge traffic noise will continue its general dominance over most of the receptors in this corridor. The noise levels at Receptor 3, the Commandant's house, include the noise blocking benefit of the historic wall since all calculations are based on ground level (standing head height) observer elevations. Noise at Receptor 1, the gate to the National Park area is influenced by the distance to the nearest ramp in each Alternative, particularly for the 1995 projected traffic volumes.

NIGHTTIME NOISE

Nighttime traffic data were available for only the Tobin Bridge for which the current weekday volume of noisy trucks is nearly constant at around 30 per hour in each direction between 5:30 p.m. and 4:30 a.m. Trucks represent an average of about 10 percent of the combined vehicle volume during this period, about double the percentage of trucks during the peak daytime period for which noise projections were computed. Nevertheless, the reduction in hourly L_{10} for receptors up to 200 ft. from the Bridge is expected to be about 7 dB relative to the daytime rush hour value. This decrease also applies to all alternatives in 1985 and 1995 since the Tobin Bridge traffic is not projected to change significantly over this period and because local truck traffic volumes at night are probably not going to be significant.

CONSTRUCTION NOISE

At present, construction equipment noise has not come under federal regulation, except for portable air compressors effective 1978, hence current fairly loud equipment noise levels can be assumed representative of construction equipment to be used in the proposed construction. Noise levels range roughly from 80 to 90 dB(A) at 50 ft. Practical control of construction noise is limited to (a) scheduling the noisiest operations such as use of jack-hammers and pile drivers, during periods of rush hour traffic and when people are likely to be least disturbed by noise; (b) checking equipment for proper mufflers and proper maintenance of other noise reducing devices; (c) locating any stationary noise generating equipment such as generators, compressors and pumps as far as possible from noise sensitive areas. Most of the construction will be taking place on the currently less sensitive side of the Tobin Bridge, hence the construction noise will be partially masked by general traffic noise. Truck detours resulting from temporary re-routing due to the construction may produce added impact, particularly if these routes were to include streets that presently carry little truck traffic. Such conditions

should be minimized. Existing truck routes should be used as much as possible.

VIBRATIONS IN NEARBY BUILDINGS

Large vehicles passing over expansion joints, potholes and uneven pavement surfaces will create roadway vibrations. These vibrations are most obvious for elevated structures in which deck vibrations readily produce sound waves. Vibrations may also be felt in buildings close to a roadway. The more common indicator of uneven road surfaces is, however, the airborne noise from "bouncing" tires and the rattling of components such as tailgate hardware, and large flexible side panels of truck trailers. Highway vibrations, per se, are generally not of sufficient amplitude even at close proximity between pavement and building foundation, say 2 ft., to equal the threshold for damaging vibrations. Thus, there should be no concern whatsoever for structural damage at the Commandant's house (Receptor 3) from either Tobin Bridge or Chelsea-Water Street Connector truck traffic. One final comment on this subject is that low frequency exhaust noise emission of large vehicles often excites natural resonances of rooms, building components, and "contents". Common examples of this phenomenon are rattling of poorly fitting windows, or glasses in a cupboard, that barely touch, tinkling against one another when a noisy truck or aircraft passes. The energy that excites these vibrations is, of course, strictly transmitted through the air and even though it produces acoustical effects that could just as easily be produced by ground borne vibrations, it can not be controlled by any method of isolating of the roadway vibrations from the building. Thus, while some people living near highways believe their houses are subjected to severe roadway vibrations, low frequency sounds produced by vibrating roadway decks and trailer side walls, and higher pitched sounds of rattling vehicle parts are the sources of their concern.

GENERAL

The modest change in overall noise level in Charlestown predicted by these calculations for the build alternatives is not too surprising. The slight improvement expected in several specific areas is balanced by an overall increase in traffic flow and higher noise in presently less critical land use areas along the Tobin Bridge, on the Shipyard side. The design goal of $L_{10} = 70$ dB(A) is exceeded along all major arterials and the Tobin Bridge corridor. No significant reduction in the noise impact on Charlestown, either overall or on specific streets, can be expected under the projected increases in traffic and population unless a drastic change in one or more parameters of traffic noise occurs. Possible measures might include enforceable truck exclusions from noise sensitive land use areas and deeply depressed local truck routes.

D. Water Quality

Existing water quality in the Little Mystic Channel was determined by field survey and analysis data from previous studies. Impacts of the Alternatives were projected and compared to existing conditions. For details, see Appendix G.

CRITERIA

A large number of physical, chemical and biological criteria are used to evaluate water quality; they are described in Appendix G.

EXISTING CONDITIONS

The Little Mystic Channel is approximately 1,005 meters (3,300 feet) long and has an average width of about 96 meters (315 feet). Total surface area of the water is 97,000 square meters (1.05×10^6 square feet). Water depth ranges from 0-10.6 meters (0-35 feet) at mean low water. Total volume is about 630,000 cubic meters (1.67×10^8 gal.). The average tidal excursion is 2.9 meters (9.5 feet) and flushes 281,000 cubic meters (7.4×10^7 gal.) of water per tidal cycle.

According to the U.S. Coast Guard⁽¹⁾, no information is available on the currents in the Channel. It can be assumed that they are proportionally lower than the currents in the Inner Harbor at the mouth of the Channel. The velocities and directions of spring currents in the Inner Harbor are shown in Appendix G.

Sources of Pollution. Six point sources of pollution flow into the Little Mystic Channel (see Figure 5h). There is one combined sewer overflow at the end of Chelsea Street and two storm water outlets, one located at the southwest term tip of the Channel and one off Country Way. Existing data for the combined sewer overflow and the estimated discharges from the storm sewer outlet are summarized in Appendix G.

Urban stormwater runoff typically contains substantial amounts of pollutants, which can contribute to a variety of problems, including pollution of receiving waters, overloading of sewage treatment plants and decreased efficiency of sewer systems.

Sources of pollutants are debris and contaminants from streets, dirt and debris from open areas, publicly used chemicals, air-deposited substances, ice control salts, and dirt and contaminants washed off or emitted from vehicles. Calculations, based on available data, show that storm

(1) Footnotes refer to Bibliography in Appendix



1

Street Drain Outlets

2

Storm Sewer Outlets

3

Combined Sewer Overflow

4

Cooling Water Outlet

5

Sediment Sampling Site

Figure 5h

Little Mystic Channel Point Sources and Sampling Sites

Chelsea - Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



water runoff from separated storm system drainage area will annually discharge 8,796 lbs. of BOD₅; 48,910 lbs. of COD; 107,000 lbs. suspended solids; 380 lbs. total phosphorous; 1,496 lbs. total nitrogen; and 9×10^{14} coliform bacteria to the Channel.

Inspection of the combined sewer overflow at the corner of Chelsea and Medford Streets showed that the regulator and tidegates were not operating properly. It was apparent that dry weather flow was still properly directed to the MDC sewer system. The chemical analysis of the combined sewer overflow does not demonstrate the significance of overflows after storm events. Salinity measurements indicate that these were dry weather flows and that nearly all of the flow was sea water which had infiltrated into the pipe at high tide. Discharges after storm events are expected to contain substantially higher concentrations of pollutants. Typical combined overflow discharges contain 5×10^6 total coliform bacteria per 100 ml; 410 mg/l suspended solids; 4 mg/l phosphorus; 1 mg/l of total kjeldahl nitrogen; 115 mg/l of BOD₅. Yearly loadings from combined sewer overflows were not calculated.

There are two street and parking lot drains which are located at the entrance to the MassPort facility. These drain into the north side of the Channel under the Tobin Bridge. No chemical analysis has been done on the effluent but foam has been observed flowing from one of them. The other point source is the cooling water discharge from the Charlestown Naval Shipyard power plant. The discharge permit is for 12 million gallons per day but the present flow is 450,000 gallons per day.

Chemical analysis of the discharge is unavailable but the power plant foreman states that the only change from the raw water input from the Inner Harbor is that the temperature is raised about 5.5 degrees C (10 degrees F) (5).

Sources of non-point pollution are the drainage area on the north side of the Channel, and the Barry Playground; all of the remaining drainage area is sewerage area of 12 acres. Based on an average annual rainfall of 45 inches, it is estimated that annual pollutant loadings are approximately 860 lbs. of BOD₅; 5,400 lbs. of COD; 16,000 lbs. of suspended solids; 51 lbs. of total phosphorous; 190 lbs. of total nitrogen; and 1.3×10^{12} coliform organisms.

Water Quality Analysis. Water quality has not been studied firsthand in the Channel. Because there is no large influx of water other than that from tidal variation, water quality can be assumed to be very similar to that in the Inner Harbor. The Massachusetts Division of Water Pollution Control examined water quality in the Inner Harbor (3). This study showed that these waters cannot meet the State's SC classification (6).

The New England Aquarium studied heavy metals in the Inner Harbor in 1972⁽⁸⁾. It was found that concentrations of soluble and particulate heavy metal exceeded normal oceanic levels but they were well within the maximum concentrations recommended by the U.S. Environmental Protection Agency⁽⁹⁾. See Appendix G, Table 5.

Benthic Environment. Observation of the Channel at low tide reveals what seems to be an unhealthy benthic environment. The bottom around the edge of the Channel is covered with trash and most of the pilings are rotted. Most of the bottom seems to be composed of a fine dark clayey silt.

The littoral benthic community, especially soft-shell clams (*Mya arenaria*) and mussels (*Mytilus edulis*), is living under stress conditions. The bottom, in the area of the two clam beds, is sandy gravel which is saturated with oil to a depth of over six inches.

Aquatic Environment. Twenty-one species of finfish can be expected to be found in the Channel (see Appendix Table 7). The dominant species would be winter flounder which would be found year-round. The second most common species would be rainbow smelt which would be found during the early spring. Herring would be prevalent in spring-time and alewife in the early summer.

The dominant phytoplankton in the Channel should be diatoms and green algae. Phytoplankton concentrations can reach over one million cells per liter during spring bloom. This indicates a moderately but not excessively rich or eutrophic water body.

Invertebrates inhabiting the Channel should be the same as those found in the lower Mystic River. At least twenty-two species of invertebrates have been identified in the water of the lower Mystic River, near the Channel⁽¹⁰⁾, with the Copepods the dominant species.

SHORT TERM EFFECTS

No-Build Alternative. No significant changes in water quality are anticipated with this alternative.

Build Alternatives 2,2A,3,4. Any type of bridge construction, except one without pilings, will cause a temporary reduction in benthic populations. Dredging will have the greatest impact, especially on the less motile benthic creatures. This initial impact, although negative, is generally temporary and in some instances can be beneficial in the long run. When sludge deposits are removed and a stable substrate is exposed, the benthic community which establishes itself is often more desirable. If dredging is necessary, a suitable site for disposal of the spoil material must be found. If a suitable land disposal site cannot be located, it is recommended that the present "Foul Area, Explosives", located approximately at longitude

70 degrees 34.5 feet, latitude 42 degrees 25.5 feet, be used. This area is presently used for disposal of metallic materials.

It is expected that removal of the wooden piers from the Channel will disturb the benthos in the immediate area. This is not expected to have any major negative impact because the bottom is saturated with oil and the present community is extremely small. The present clam/mussel community does not contain any dynamically functioning population. Shell-fish from this area are not edible.

Sedimentation in the Channel, due to construction and subsequent runoff, if not controlled could cause some problems but they are not expected to be significant because most of the soils in the area are already barren.

Proper steps will be taken in order to control erosion during and after construction. Possibly the easiest and cheapest method would be to construct a small dike along the embankment in the construction area. After construction, the embankment should be repaired and the unpaved areas seeded.

LONG-TERM EFFECTS

Water quality in metropolitan areas can be significantly degraded by discharge of urban runoff to water bodies. Typically, the highest pollutant loading rates come from street surface contaminants.

The calculated drainage area of the Little Mystic Channel is 350,000m² (90 acres) and contains approximately 5.2 km (3.3 miles) of streets or 10.4 km (6.6 miles) of curb area. Most of the area is served by a separate storm drain system and a sanitary sewer. About 80% of the area is residential and about 15% is open space or parkland. The remaining 5% is industrial and commercial.

Sartor and Boyd⁽¹¹⁾ conducted a survey which characterized average contaminant loading from 40 different sectors in 10 different cities. Using this data to calculate loadings in the Little Mystic Channel, it can be shown that construction of a bridge across the Channel could increase pollutant loadings by an additional one percent. Appendix G, Table 8 shows these calculations. Distribution of pollutant loadings values could vary significantly from those in Table 8 but total additional loadings will remain at one percent.

An alternative method for determining pollutant loadings from urban runoff is to estimate worst case loadings. Worst case is defined as that in which all particulates emitted from vehicle exhausts and tires are deposited directly upon roads. Using EPA⁽¹⁴⁾ estimates of emissions in conjunction with vehicular traffic patterns, it can be shown that the bridge addition can decrease particulate

discharges by vehicles to the Channel by as much as 46% or 617 kilograms (1,358 lbs.) per year by shortening their travel route. See Appendix G for calculations. There will be a minimal significant decrease in pollutant discharges to the Channel.

One other factor which has been investigated is the possibility of accidents involving toxic or hazardous substances on the bridge. The Tobin Bridge, which handles much more traffic, has not had a "major incident" involving hazardous substances since its opening. There have been numerous small oil spills which have resulted from overflow from oil trucks on a 4% grade but they have been confined to the bridge⁽¹⁵⁾.

CONCLUSION

A definite improvement in the water quality of the Little Mystic Channel can be expected with construction of the bridge crossing which is part of Build Alternatives 2, 2A, 3 and 4. Much of this improvement can be attributed to the decrease in vehicle particulate discharges to the Channel due to shortened travel routes.

Prior to the beginning of construction, it will be necessary to obtain a Section 404 permit from the Army Corps of Engineers. The DEQE (Department of Environmental Quality Engineering) will require a Chapter 91 license for the Little Mystic Channel Crossing. The Department of Public Works will file for this license in accordance with DEQE procedures at the proper time.

5.E. Vegetation and Wildlife

Existing conditions are compared to probable habitat characteristics if the alternatives were implemented. No significant effects are anticipated and no rare or endangered species are affected.

CRITERIA

Two criteria were used to evaluate impact on vegetation and wildlife: physical removal of plant material and wildlife habitat, and the creation of an altered environment for the survival of plants and animals.

EXISTING CONDITIONS

The area under study has long been developed and is not only urban in character, but also nearly entirely paved over. Vegetation which exists here is either maintained by man as part of a landscaping effort, or grows as weeds in spite of adverse conditions. There are few street trees in the area outside the Shipyard. Next to the Commandant's house in the yard is a former orchard of fruit trees and other landscaping including grasses, shrubs, vines and flowers. The following trees and shrubs exist in the yard: American Elm, American Mountain Ash, Apple, Black Locust, Cherry, Forsythia, Honeysuckle, Horsechestnut, Magnolia, Myrtle, Norway Maple, Norway Spruce, Peach, White Spruce, Red Cedar. These trees create a residential character and backdrop to the Commandant's house while at the same time serving as a screen from the highway. Wildlife in the area is typical of urban waterfront land habitat entirely controlled by man. The following birds and wildlife have been observed: Black Backed Gull, Brown Bat, Chimney Swift, Common Tern, English Sparrow, Gray Squirrel, Herring Gull, House Mouse, House Wren, Rat, Robin, Starling. No rare or endangered species of plants or animals are known to exist in the project area.

IMPACTS

No-Build Alternative. There will be no physical removal or alteration of vegetation or wildlife habitat under the No-Build Alternative. The environment in which plants and animals live will be affected by small increases in noise level as described in Chapter 5C and by small, positive changes in air quality described in Chapter 5B. These changes will not affect survival of the existing flora and fauna.

Alternatives 2, 2A. Physical Removal - approximately 20 mature trees and a number of shrubs will be removed. (See Appendix L for names and locations.) Wildlife will not be significantly affected because it will find new urban habitats to replace the old. No sensitive natural ecosystems will be destroyed because none exist here.

Alternative 3. The impacts here are similar to 2 and 2A above, except that the area taken in 2 and 2A will be used only during construction in Alternative 3. The land on top of the tunnel can be landscaped, but it is unlikely that the mature trees removed during construction could be replanted. It might be possible to successfully move them to other locations on the property.

Alternative 4. The impacts of this Alternative are similar to those of Alternatives 2 and 2A above except that since more area is affected more vegetation and habitat will be disturbed.

The small anticipated changes in noise levels and air quality are not anticipated to have any affects on survival of remaining flora and fauna in the project area.

5. Social Impacts

As the project corridor does not go through residential areas, no direct impacts are anticipated. Secondary impacts would depend chiefly on the composition of Shipyard redevelopment rather than upon the transportation improvement itself.

CRITERIA

1. Impact on distribution of population: over the long term, the addition of roadways has been one of the principal factors influencing the distribution and timing of population growth.
2. Physical takings: takings can have a disruptive social effect by removing functional parts of the neighborhood: a local community center, playground, school, or housing.
3. Barrier effects: a highway can act as a barrier, cutting off the neighborhoods from valued resources such as parkland schools. A road can also divide a once continuous neighborhood.
4. Disruption of ambient environment: increased air pollution, noise levels, and traffic volumes can disrupt the residential character of a neighborhood.

EXISTING CONDITIONS

Demographic and housing characteristics of Charlestown are described in Appendix H. No private residences and only one business are in the project corridor.

IMPACTS

No-Build. No physical takings are anticipated as a result of the No-Build. However, by increasing traffic on local streets, the No-Build Alternative will increase existing barrier effects caused by traffic on local streets, especially Lowney Way, Bunker Hill Street, Vine Street, and Medford Street. There will also be infiltration of other streets by cars and trucks as described in Chapter 5.A above. This would adversely affect the ambient environment.

Build Alternatives. 1. None of the Build Alternatives will directly affect population distribution. By facilitating Shipyard redevelopment, the Alternatives may indirectly create pressure on the housing stock if Shipyard reuses encourage employees to live in Charlestown. This effect may be somewhat mitigated by housing built in the Shipyard itself. Alternatives 2, 2A, and 3 would have the greatest indirect impact and Alternative 4 the least.

2. No residential takings are involved and only one business, a tavern, is displaced (see Chapter 5K).

3. The Build Alternatives will reduce direct and indirect

barrier effects. New roadways and ramps occur between areas already separated by the Tobin Bridge. At the same time a new at-grade crossing will be provided between the residential community and Shipyard Gate 4.

4. The chief impact of Alternatives 2, 2A, 3 and 4 on the ambient social environment will be indirect. They will lead to reduced traffic in residential areas, especially trucks on the eastern end of Medford Street and along Lowney Way.

5.G. Public Services and Facilities

5.G.1. Fire Protection

EXISTING CONDITIONS

The existing fire station servicing the southern area of Charlestown is at Winthrop Square. A new facility is needed and may be located in the Shipyard fire station (Building #200), or outside of the Shipyard at Joiner and Call Street near City Square.

CRITERIA

The factor which determines impact on fire protection is access for fire fighting equipment.

IMPACTS

No-Build. Increased congestion could slow down access from either proposed facility.

Alternatives 2, 2A, 4. Winthrop Square and Joiner/Call Street: access would be increased to the service area. Shipyard site: Gates 1, 4 and 5 would be open, Gate 2 would be closed. Gate 4 will require modification to accommodate fire apparatus.

Alternative 3. Winthrop Square and Joiner/Call Streets: access would be increased to the service area. Shipyard site: Gates 1, 4 and 5 would be open, but Gates 1 and 4 would be for emergency use only. Gate 4 will require modification to accommodate fire apparatus.

5.G.2. Police Protection

EXISTING CONDITIONS

Existing access from the police station in City Square to the Bunker Hill and Medford Street areas is somewhat circuitous and subject to congestion.

CRITERIA

The criteria used to evaluate impact on police service is readiness of access to all areas.

IMPACTS

No-Build. Increased congestion could slow access, especially during rush hours.

Build Alternatives. All Build Alternatives would increase police mobility by providing two new street links. There would be some additional territory to patrol for traffic enforcement. Because the roadway has only one six-foot sidewalk, and does not lead directly to residential areas, it seems unlikely that it would lead to an increase in crime in Charlestown.

5.G.3. Schools

EXISTING CONDITIONS

There is one school in the immediate area, the Kent School, and a high school is to be constructed across the intersection of Medford and Terminal Streets. The athletic facility at Medford and Terminal Streets is already under construction.

CRITERIA

The criterion used to evaluate impact on schools is traffic on the streets between the schools and the residential areas.

IMPACTS

No-Build. The No-Build Alternative will lead to increased traffic at Terminal and Medford Streets, Bunker Hill Street, Vine Street and other local streets in the areas around the school.

Build Alternatives. All the Build Alternatives will divert traffic from the corner of Terminal and Medford Streets, and therefore reduce hazards to students. The reduction in truck and other traffic on Bunker Hill Street and Lowney Way will make access to the Kent School safer as well as reducing ambient noise levels and air pollution.

Traffic will be reduced on other streets near schools, except for Chelsea Street. A pedestrian crossing of this street will be provided to the Shipyard. If family housing is provided in the Shipyard, children would use this crossing to reach the Kent School. An additional crossing would be required to Medford Street at Gate 5.

All other public services, such as solid waste collection, water supply, health, day care, and the library will benefit by increased accessibility and reduced street congestion.

5.H. Land Use Planning Impacts

The Alternatives have both direct and indirect impacts on land use planning in the project area. Direct impacts occur chiefly in the National Park while indirect impacts are related to potential reuses of the Shipyard. Impacts on other aspects of land use are discussed in other sections of this chapter.

CRITERIA

The basic criterion used to evaluate the land use planning impacts of an Alternative is whether those particular improvements tend to assist or constrain proposed land use plans.

EXISTING CONDITIONS

Existing land uses and planning efforts for the future have already been described in detail in Chapter 2.D.4.

IMPACTS

No-Build. This Alternative has no direct impacts. Because it lacks improved access to the northern part of the Shipyard, the No-Build Alternative will limit the possibility of the full development of this part of the Shipyard as proposed by the BRA. Access to the new National Park will be available through Gates 1 and 2, but any parking or other associated visitor services to be provided in the northern part of the yard will be difficult to reach. The National Park Service could decide to keep Gates 1 and 2 open to visitors in order to allow them to reach the northern part of the yard, but it seems unlikely that this access would stimulate growth in the Shipyard or create a desirable park environment.

Under the No-Build Alternative, access to the BHA property under the Tobin Bridge will become more difficult because of the increased traffic volume circulating around its edges. Land along Water Street near Gates 1 and 2 can be developed for tourist-related uses.

Build Alternatives. The Build Alternatives take approximately 0.75-1 acre from land already owned by the National Park Service. See Chapter 5.K, Chapter 6 and Chapter 7 for a detailed discussion of these takings and their implications.

Alternatives 2, 2A, 3. Potential for development of new land uses and the new National Park in the Shipyard will be greatly enhanced by these Alternatives. They will also enhance opportunities for development of tourist-related land uses along Water Street through landscaping presently neglected areas (see Chapter 5.N.2.)

Land owned by the Boston Housing Authority under the Tobin Bridge will not be affected and will remain available for future development as a playground; moreover, its area may

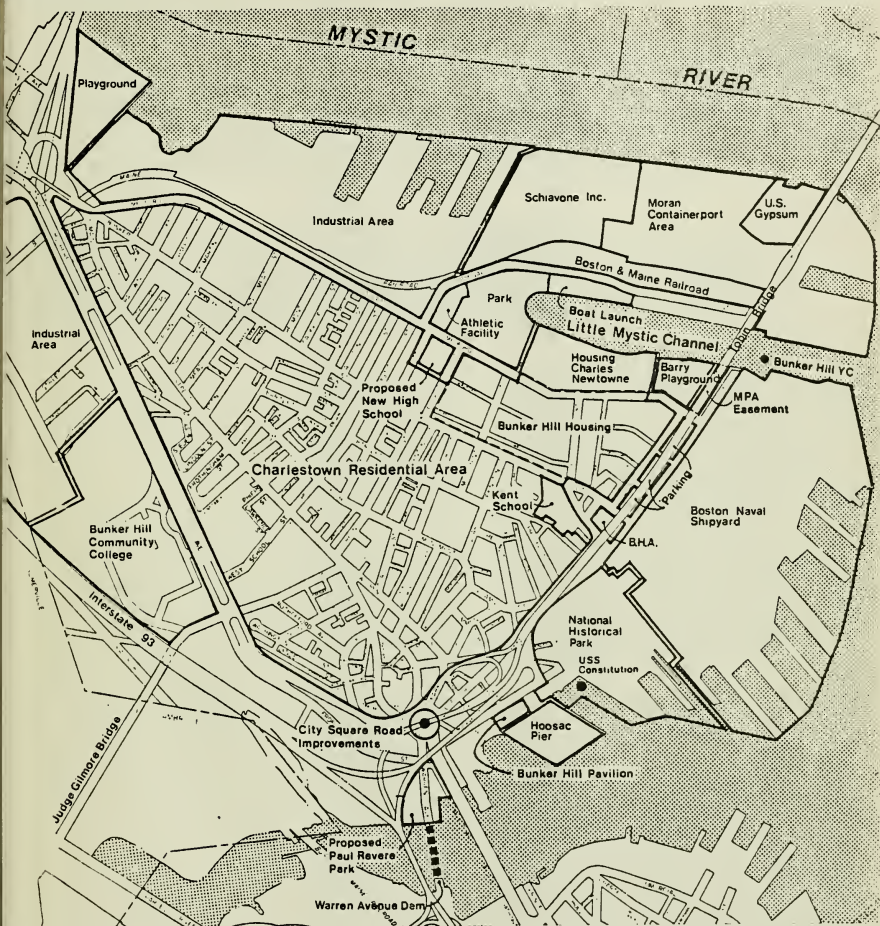
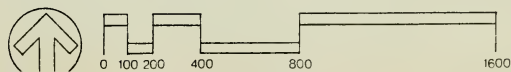


Figure 5i

Charlestown: Project-Related Land Use

Chelsea-Water Streets Connector · Little Mystic Channel Crossing
Draft Negative Declaration



be increased by the closing of Bunker Hill Street between Lowney Way and Chelsea Street.

The boat launching ramp on the Little Mystic Channel will be limited in use to those boats which can pass under the new bridge's ten-foot clearance at mean high water. Most sailboats would not be able to pass through, although most motorboats and all rowboats would not be restricted. Current use is very light and confined to small motor and rowboats.

Alternative 4. All impacts will be the same as for Alternatives 2A and 3 except that full development of the northern part of the Shipyard will be somewhat restrained by the smaller capacity of the roadway as designed. However, the smaller investment of this scheme provides the flexibility to upgrade capacity when and if it becomes necessary.

I. Economic Impacts

The economic impacts of the Alternatives were evaluated at the local, subregional, and regional scales with appropriate criteria at each level. The No-Build Alternative has no direct impacts; but its indirect impacts are significant in terms of economic activity inhibited or foregone. By contrast, both the direct and indirect impacts of the Build Alternatives are generally positive and would provide net benefits at all scales of evaluation.

EXISTING CONDITIONS

The employment and income distribution characteristics of Charlestown residents are described in Appendix H. Charlestown is recognized as a major employment center within the City of Boston with approximately 100 firms situated in the study area.

Principal employers are located on major arteries which generate a significant volume of truck traffic. Two sugar refineries are on Medford Street, the MassPort Moran Container Terminal on Terminal Street, H.P. Hood on Rutherford Avenue and numerous warehouse operations located along the Mystic River, B&M Railroad lines and the Charles River. The majority of retail activity is concentrated in the Main Street at Thompson Square area, and along Bunker Hill Street.

The study area has not exhibited significant growth in employment in recent years, and has probably experienced an absolute decline in employment due to the closing of the Naval Shipyard and the closing of other businesses in the community. Some of this employment loss has been made up by employment generated at such new facilities as the Bunker Hill Community College.

The primary industries and trip generators in the study area are discussed below:

Moran Terminal. This container facility has 1,100 feet of dock area and is becoming increasingly important to the local as well as regional economy. Container movement at the Moran facility has increased by 106% from 1972 to 1974. It is anticipated that operating capacity will increase significantly in the near future with the help of a new computer system. This system will assist in controlling inventory and will coordinate container on-loading and off-loading in more efficient ways than are presently being used. Supervisory personnel at the container facility expect their present "peak" capacity of up to 4,000 container movements per month to increase substantially.

It is estimated that approximately 90-95% of the cargo passing through the terminal is local cargo destined for New England markets closer to Boston than Springfield, Massachusetts or Portland, Maine. For such local destinations, trucks are the most efficient form of transportation from the piers both in terms of time and rates.

For the Moran Terminal to become increasingly competitive with other major east coast container ports, the utilization of rail transfer to move cargo into the interior of the continent or for transcontinental shipment will be necessary. Pending standardized rail shipping rates would make Boston competitive with all other eastern seaboard container ports. If agreements are made ratifying this standardization of rates then it is believed that the container traffic passing through Moran would increase and that a larger share of the movements would be by rail rather than by truck.

U.S. Gypsum. This operation is involved in converting raw materials, which are delivered by ship, into wallboard. The wallboard is shipped by flatbed trucks (with sides and canvas) to different destinations throughout the region. Materials for the operation, such as propane and fuels, are trucked in as needed -- probably infrequently.

The prime truckers for U.S. Gypsum were contacted to identify the shipment flow on Charlestown roadways. They operate 28 trucks from the Gypsum plant per day and at peak periods supplement their normal fleet with three or four "gypsy" trucks.

Visitor Attractions. Visitor attractions in Charlestown are becoming an increasingly more important component of the economic base in the study area. Existing attractions, such as the U.S.S. Constitution, the Bunker Hill Monument, and Raytheon's Bunker Hill Pavilion, are luring greater numbers of visitors into the study area, primarily in the vicinity of the Shipyard.

The U.S.S. Constitution is anticipated to have a total visitation of 850,000 in 1975, an increase of 67% over the past ten years. Since its opening on June 17, 1975, the Raytheon facility, which adjoins the proposed Charlestown Naval Shipyard National Historical Park, has attendance of 91,000 (attendance for the period June 17 - October 1, 1975). The impact of these visitor attractions will be significantly greater as proposed reuse of the northern part of the Shipyard takes place.

CRITERIA FOR LOCAL COMMUNITY IMPACTS

Roadway construction in the study area can have numerous economic effects on both the short- and long-term economic growth to the community itself as well as its citizens and business people. Many of these impacts are measurable, although some which are clearly evident are not easily quantifiable. The following criteria are used to evaluate these local effects:

Criterion 1 -- Business Displacement: the relocation of business for purposes of highway construction includes all businesses whose operation might have to be terminated at their present site.

Criterion 2 -- Impact on Local Employment: the affected total employment in business and manufacturing establishments is based on estimates of employees in displaced businesses.

Criterion 3 -- Impact on Existing Business Operations: the effects of construction Alternatives on existing local firms are discussed.

Criterion 4 -- Impact on Local Tax Base and Land Values: the effects of right-of-way acquisitions are estimated on the local tax base and the future impact of roadway construction on property values and new development are discussed.

Criterion 5 -- Impacts During Construction Period: an evaluation of the relative consequences of alternative transportation facilities on the operation of existing firms during the construction period is made. These impacts are extremely sensitive to facility design and implementation.

Criterion 6 -- Urban Development Opportunities: transportation improvements, by providing better accessibility, tend to accelerate residential, commercial, and manufacturing development. The rate, degree, and direction will depend, among other things, on the mode of transport, surrounding uses, general and specific market forces, joint development plans, and the site itself.

IMPACTS

No-Build. This Alternative will have long-term negative secondary impacts by making Charlestown less desirable as an industrial or retail location. This effect is primarily due to increased congestion and difficult access. In addition, the secondary impacts of a No-Build decision would tend to inhibit complete development opportunities at the Naval Shipyard and adjoining properties due to a limited access condition that can only be expected to become more congested.

Build Alternatives. *Business Displacement:* the only non-governmental property taken is a tavern located on Chelsea Street. For more than 30 years this establishment has served the personnel at the Naval Shipyard and local residents. With the closing of the Shipyard, the tavern has lost a major segment of its market potential. Relocation of this establishment would be subject to liquor license regulations and the availability of a suitable site in Charlestown (see Chapter 5K).

Impact on Local Employment: it is estimated that fewer than five employees will be affected at the tavern. The long-term, positive employment impacts created by the redevelopment of the Charlestown Naval Shipyard, development of visitor attractions at the waterfront, and the expansion of industry in the study area will greatly outweigh the potential

loss of employment to this single business.

Impact on Existing Business: no significant impact is created on existing local retail activity. It can be expected that the improvements will generally aid economic growth in the study area via induced development potential through increased accessibility; expenditures for retail goods and services can be expected to increase in proportion to growth in other sectors of the local economy.

Tax Base Impact and Land Value: the only right-of-way acquisition of private property involves one tavern. The removal of this property from the tax rolls will not represent a significant economic loss (\$2,300/yr.) to the city in terms of taxes in light of the anticipated development potential in the immediate area of the roadway improvements that would be associated with more efficient traffic flows created by these improvements.

Prior planning studies for the Shipyard indicate that total direct revenues at completion of proposed redevelopment plan for the Shipyard, will be greater than \$7 million annually, expressed in 1974 dollars. These revenues would come from property taxes, consumer and transaction taxes, business excise taxes and other miscellaneous taxes.

Roadway improvement benefits can also be realized in terms of increasing land values in the immediately adjacent commercial and residential areas. In regards to commercial development, greater access to a particular location translates into user travel time savings. The four Build Alternatives will tend to have a positive impact on induced commercial development in proportion to the transportation service they provide.

The construction of the bridge across the Little Mystic Channel can only benefit industrial expansion along Mystic Pier #1. The bridge will also lead to greater separation between residential and industrial uses along eastern Medford Street. This will, in turn, tend to strengthen the economic viability of the residential area as property owners will be more inclined to spend money on property improvements and maximize the development potential of the area, thereby accelerating land values.

Construction/Local Impacts: potential problems may arise during construction due to disruption of access into the study area and detours that would impact local businesses. Examples of this could be access to the U.S.S. Constitution Bunker Hill Pavilion, and Hoosac Pier #1. It is generally felt, however, that limited negative economic impacts would be created by construction of any of the roadway alternatives discussed in this report.

Urban Development Opportunities: a roadway improvement, by providing increased accessibility, can serve as a catalyst for urban land development. The major beneficiaries

of improved access created by the four Build Alternatives are redevelopment of the Shipyard and adjoining visitor attractions which must be easily accessible to workers, visitors and residents; industries in the study area that are highly dependent on direct truck access to the regional highway network; and the residential community of Charlestown that can exhibit economic growth as a spin-off of induced development in the surrounding area. See Chapter 5N for more detail.

New development usually means expansion of the tax base of the community and economic support for jobs and income. This is exceedingly difficult to measure since it is site-specific, sensitive to facility design, long-term and influenced by external factors such as market forces, surrounding land uses and general economic conditions.

For future development, reuse of the Boston Naval Shipyard represents the most significant urban development opportunity in the study area. At this time, the planning process for this massive project has not progressed to the point at which clearly definable economic impacts can be associated with specific roadway/access alternatives except to state that:

.The U.S.S. Constitution and the Bunker Hill Pavilion will attract approximately 1.5 million people yearly to the southern portions of the Shipyard. Improvement of access roadway to the area will be required to maximize development opportunities.

.Alternatives 2, 2A and 3 appear to provide equally the needed linkage to the Shipyard and adjoining properties and are thus supportive of development potential.

.Alternative 4 is designed to serve approximately 35% of full Shipyard reuse potential. As that level is approached, further redevelopment may be inhibited unless Alternative 4's ramp and intersection capacity is improved to match that of the other Build Alternatives.

CRITERIA FOR SUBREGIONAL IMPACTS

Due to the limited scale of proposed roadway improvements and bridge construction, the subregional area evaluated consists of the Boston CBD/downtown area and Charlestown. Economic criteria for the subregional area relate to long-term economic influences, e.g., the secondary effects of roadway alternatives.

Criteria: Three criteria are applied to evaluate subregional employment impacts of changes in accessibility:

1. effect on employment distribution
2. effect on employment opportunity -- labor force accessibility
3. effects on manufacturing, retail and wholesale industries,

particularly as related to goods movement.

IMPACTS

No-Build. This Alternative does not change any existing employment characteristics of the subregional economy and therefore has no direct impacts on it, but would severely constrain redevelopment of the northern Shipyard.

Build Alternatives. The effects of the Build Alternatives on subregional employment will be related to employment distribution, employment opportunity and effects on the manufacturing, retail and wholesale sectors.

Employment Distribution: the highway access links and bridge over the Little Mystic Channel will tend to increase the attractiveness of new sites for development within the study area by alleviating traffic congestion along the major arteries in the immediate vicinity of the Naval Shipyard and Mystic Pier #1. As is the case with population distribution from a subregional perspective, it will not be significantly affected by the modest roadway improvement envisioned under the four Build Alternatives except as related to enhancing local redevelopment opportunities.

Employment Accessibility: the Build Alternatives described herein will have a positive impact in relation to improving traffic flows and access to the Shipyard and the Mystic Pier area where the largest concentration of future development is likely to occur in the study area.

Goods Movement: the improved roadway linkage created by the Build Alternatives will offer less congested truck movement within the study area and thus make the industrial areas more desirable for commercial development and for distribution of goods by alternating time/distance factors. This positive impact is particularly important.

CRITERIA FOR REGIONAL IMPACTS

The most immediate effect of spending on road-way construction is the creation of employment and wages. This has been evaluated in terms of both on-site and off-site employment gains as an important indicator of regional benefits.

Criterion 1 -- On-Site Employment generated by construction was evaluated in terms of man-years of effort. Although there is some variation with the type of construction, it has been assumed that on the average 30% of total construction costs will be spent on wages at an average annual rate of \$12,000 per employee.

Criterion 2 -- Off-Site Employment gains are assumed to occur in direct proportion to the scale of construction.

IMPACTS

No-Build. As no expenditures of funds are involved, this Alternative has no direct regional employment effects.

Build Alternatives. *On-Site Employment:* with a four-lane curved bridge crossing the construction costs for each Build Alternative are as follows.

Alternative 2	\$ 4,290,000	107 man-years
Alternative 2A	\$ 4,360,000	109 man-years
Alternative 3	\$10,030,000	251 man-years
Alternative 4	\$ 3,790,000	95 man-years

With a four-lane straight bridge crossing the construction costs for each Build Alternative are as follows.

Alternative 2	\$ 3,310,000	83 man-years
Alternative 2A	\$ 3,380,000	84 man-years
Alternative 3	\$ 9,050,000	226 man-years
Alternative 4	\$ 2,810,000	70 man-years

Benefits would be proportionately less with a two-lane crossing and approximately 21 man-years less per Alternative. Thus Alternative 3 would generate the most employment and Alternative 4 the least.

Off-Site Employment: other sectors of the economy are also affected by roadway construction in terms of indirect employment. As such, it is estimated that the direct employment presented above for each Alternative is approximately one-half of the total construction-employment-related opportunities generated.

5.J. Public Lands and Acquisition

Most of the land to be acquired for any of the Build Alternatives is publicly owned. Existing ownership and use of potentially affected parcels are discussed below and shown in Figures 5j and 5k. Please use these maps and the fold-out plates at the back of the report to see the areas subject to land takings in each Alternative.

CRITERIA

Taking impacts are evaluated according to (1) the effect of the taking on the existing use of the land, and (2) the amount of the taking.

Criterion 1 -- Effect of Taking:

No-Build. This Alternative involves no takings.

Build Alternatives. Takings are discussed by property and summarized in Table 5.J-1.

DPW-owned Parking Off Water Street: the land is currently used for parking for DPW employees only. It was formerly used for parking for visitors to the U.S.S. Constitution. All Build Alternatives require use of this land for ramps and roadways carrying southbound traffic from Chelsea Street to Water Street.

BRA-owned Land in the Vicinity of Gate 1: a parcel bounded by Wapping Street, Water Street, and the Water Street off-ramp, and a small parcel just north of it, bounded by Wapping Street and Henley Street are owned by the BRA and not currently in use. The buildings on the first site were demolished and the other site is occasionally used for parking. All the Build Schemes would require its use for roadway purposes.

DPW-owned Land in the Vicinity of Gate 2: the DPW owns a small piece of land in front of the garage, Building 204, outside the Shipyard. It is not currently used.

The above parcels of land were originally scheduled to be acquired by the National Park Service to enable them to design and control access to the National Park Site. A joint planning team of the BRA and the Park Service is currently developing alternative entrance strategies.

City-owned Streets: portions of Wapping, Henley and Water Streets would be used for the new connector in all Build Alternatives. All the portions lead to Gate 1 and Gate 2 and are used only for access to those Gates.

U.S. Government Property: takings from the Shipyard are detailed in the Section 4(f) report (Chapter 7) and in Table 5.J-2. Most land is outside the granite wall, and includes a garage building (204). Smaller takings inside the wall and the relocation of the wall itself will be necessary. This land is owned by the National Park Service.

Boston Housing Authority Land: no land will be taken by any Alternative from the property owned by BHA under the Tobin Bridge and bounded by Chelsea Street, Vine Street, Hunter Street, and Bunker Hill Street. At the present time, the fence surrounding the area is in disrepair and the pavement is covered with broken glass and other litter. In 1973 the BHA stated that this land would soon be developed into a recreation facility. In an interview in September, 1975, their planning section said that problems had delayed its development, and that use of the Chelsea Street side of the property for roadway purposes would not interfere with their plans (see letter in Appendix I).

All Build Alternatives will remove traffic from Vine, Hunter, and Bunker Hill Streets and route it onto Chelsea Street, making the land more accessible to pedestrians from the residential areas.

Boston Parks and Recreation Department land: the 5.72 acre William J. Barry Playground is bordered by the Little Mystic Channel, Chelsea and Medford Streets, and Charles New Towne. On December 4, 1947 the Massachusetts Port Authority secured an easement on 1.51 acres at the eastern end of the playground (see Grantor Book-City of Boston 17, p.207; Deed Book 6390, p.133 and Deed Book 6426 p.170) which allows permanent Massport use of the area for purposes of constructing, maintaining, repairing and operating the Tobin Bridge. When the Tobin Bridge was constructed, support columns were placed directly in front of the concrete grandstand. The ball field was moved northwest and the area under the Bridge was fenced off. The proposed curved bridge across the Channel will take approximately 4200 sf. from the northeast corner of the easement, an area currently paved over and inaccessible to playground users. The proposed straight bridge will take approximately 5800 sf. from the same area. FHWA field review has established that the taking does not require 4(f) review (see FHWA Regs. Vol.7, Ch.7, Sec.2.20d).

The Parks Department also has jurisdiction over a small boat launching ramp and parking lot on the northern side of the Channel.

Both the curved and straight bridges will have a ten-foot clearance at mean high water across the 75-foot Channel, allowing small boats to pass underneath. Current use of the ramp is light and exclusively by small motor and row boats.

BRA land: the BRA owns the land from the boat ramp parking lot to the Tobin Bridge along the north side of the Channel. This land will be used for an abutment of the new bridge, curved or straight, and an intersection of the new roadway with Terminal Street.

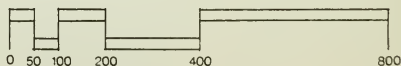
Boston and Maine Railroad: the Boston and Maine Railroad owns the rail yards to the north of Terminal Street. In the straight bridge alignment it will be necessary to acquire approximately 1500 sf. from the B&M. Two of the three tracks



In- and near the proposed Right-of-Way

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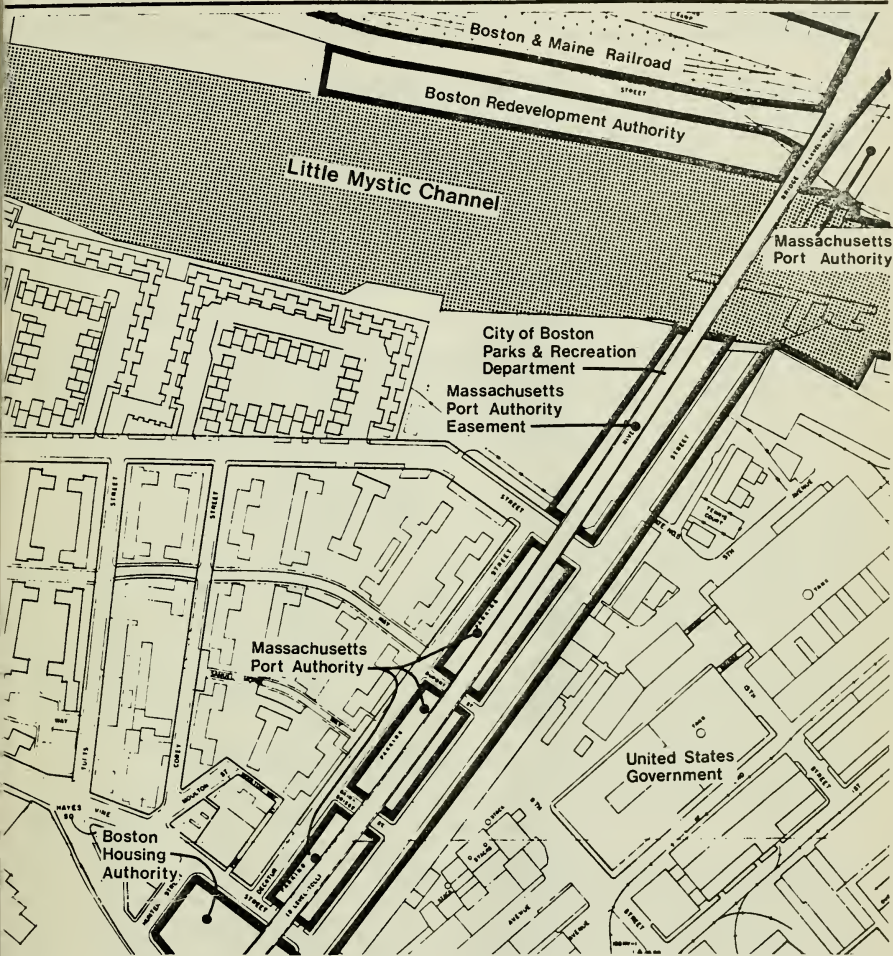
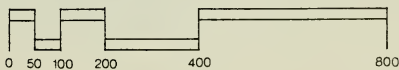


Figure 5k

Land Ownership

In- and near the proposed Right-of-Way

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serving Mystic Pier 1 will be truncated, but railroad service to the pier will continue with one track and a switch on the Pier.

Tavern: a privately-owned tavern on Chelsea Street opposite Gate 4 of the Shipyard will be affected. Although only 800 sq.ft. will be required, the taking will include a portion of the building. It will be necessary to acquire the 2,555 sq.ft. property and offer relocation assistance (see Ch.5.K).

Criterion 2 -- Amount of Takings

No-Build. This Alternative has no taking impacts.

Build Alternatives. Table 5.J-1 below indicates the approximate amount of land required from the listed property owners for each Build Alternative. Table 5.J-2 details the area around the Commandant's house affected by the Alternatives. For public lands, the figures only reflect land area to be used for roadway and associated purposes.

Table 5.J-1 Property Acquisitions by Alternative (sq.ft.)
(Curved Bridge Element)

	<u>Alt.2</u>	<u>Alt.2A</u>	<u>Alt.3</u>	<u>Alt.4</u>
U.S. Government	33,850	36,900	31,400*	26,900
Mass. DPW	27,550	28,950	26,350	29,600
MassPort Authority	1,000	1,000	1,000	1,000
Boston Parks & Rec.**	4,200	4,200	4,200	4,200
BRA	54,800	58,200	59,000	56,100
Private	<u>2,555</u>	<u>2,555</u>	<u>2,555</u>	<u>2,555</u>
Total Sq.Ft.	123,955	131,805	124,505	120,355
Total Acres	2.85	3.03	2.86	2.76

Property Acquisitions by Alternative (sq.ft.)
(Straight Bridge Element)

	<u>Alt.2</u>	<u>Alt.2A</u>	<u>Alt.3</u>	<u>Alt.4</u>
U.S. Government	33,850	36,900	31,400*	26,900
Mass. DPW	27,550	28,950	26,350	29,600
MassPort Authority	1,000	1,000	1,000	1,000
Boston Parks & Rec.**	5,800	5,800	5,800	5,800
BRA	30,600	34,000	34,800	31,900
Boston & Maine RR	1,500	1,500	1,500	1,500
Private	<u>2,555</u>	<u>2,555</u>	<u>2,555</u>	<u>2,555</u>
Total Sq.Ft.	102,855	110,705	103,405	99,255
Total Acres	2.36	2.54	2.37	2.28

*Actual taking after construction is complete.

**This taking is based on four-lane bridge; it would be somewhat smaller for a two-lane bridge. Taking occurs entirely within the easement held by MassPort in this area.

K. Displacement and Relocation

One business, a tavern located at 131 Chelsea Street, will be displaced. Although only 800 sq.ft. are necessary for the improvements, this taking includes the front portion of the building; it is therefore possible that the entire property may be taken.

DESCRIPTION OF PROPERTY

Number of Structures:	One
Name of Business:	McAvoy's
Location:	129-131 Chelsea St., Charlestown
Type of Business:	Tavern and restaurant
Structure:	Brick and concrete, one story
Approximate Floor Area:	2,555 sq.ft.

RELOCATION PROBLEMS

The owner does not wish to be displaced or relocated. There have been recent efforts in Charlestown to reduce the number of bars by not permitting moving of licenses. Actual sites zoned properly, and the correct distances from other special uses would be difficult, but not impossible, to find in Charlestown. Opinions voiced by residents at public meetings indicate they support the taking of the bar.

Drinking establishments may retain their liquor licenses for a period of four years from the date of their physical displacement and retain the right to transfer the license to new quarters. However, finding a new location in Charlestown, or in any other neighborhood in the City of Boston is inhibited by neighborhood resistance to new liquor establishments. The major problem to be anticipated is the transfer of the liquor license which will most likely be opposed by members of the community.

Charlestown realtors feel that the best area for relocating the tavern in Charlestown would be on Bunker Hill Street where there are proper zoning, suitable buildings, and a continuation of the present market. The bar's customers are mostly from the Terminal area, which is even closer to Bunker Hill Street than it is to the present location on Chelsea Street.

No other ongoing federally-funded projects are known to be causing displacement of similar businesses in Charlestown. Since vacancies occur relatively frequently on Bunker Hill Street, realtors feel that, except for a number of thirsty people, there would be no difficulty in finding acceptable rental or sale property in a four-to-six month time period.

A displaced business may receive MDPW assistance in number of ways:

1. Full fair market value for business property.
2. Actual reasonable moving expenses; assistance in finding a relocation site or compensation for time spent in search.
3. Payment in lieu of moving expenses up to \$10,000.

Once an alternative is selected, the MDPW Right-of-Way Bureau would initiate relocation assistance procedures.

5.L. Historic and Cultural Resources

The Boston Naval Shipyard is the only historic property to be impacted by the proposed improvements. The entire yard is listed on the National Register of Historic Places. For purposes of federally-funded (FHWA) road improvements, this property is protected by both Section 4(f) of the Transportation Act of 1966 and Section 106 of the Historic Preservation Act of 1966. The reviews appropriate to these requirements contain detailed descriptions of the buildings, impacts, and plans of the National Park Service. Chapters 7 and 8 of this report contain detailed analysis of the information summarized here.

The proposed improvements will affect a number of historic structures within the Shipyard including a granite wall (1825-26), the Commandant's House (Quarters G, 1805), the Marine Barracks (Quarters I, pre-1823), Officers' Quarters (Buildings 262-265, 1826), Ropewalk (Building 58, 1836), and a Gate House (Building 1, 1915). A portion of the granite wall is taken as are three other structures of less historic interest (Buildings 204, 245, 269). (See fig. 51.)

CRITERIA

Three criteria were used to evaluate the impact on historic resources:

Physical Alteration: Changes caused by the highway may include regrading, removal of vegetation, elements out of character or scale with the existing environment, natural or man-made, the taking of land from historic properties and the removal of physical facilities or amenities on that land.

Barrier Effects: A highway is in itself a physical and psychological barrier for pedestrians. The question is whether the road disrupts or enhances existing pedestrian vehicular or visual access to a resource, separates areas of compatible use or causes community disruption by dividing a neighborhood from a playground or other resource.

Effect on Ambient Environment: New construction may present an opportunity to enhance desirable features of land use, landscape, etc., but it may also have a disruptive effect by causing a conflict in use or by changing the special character which makes a particular area a valued resource.

SECURITY IMPACTS

No-Build. There will be no physical alteration of historic resources, or any change in the existing barrier effects of the Tobin Bridge and its approaches. The increased traffic projected to be generated by new uses in the northern part of the Shipyard would cause extreme congestion outside the yard and could lead to the decision to open Gates 1 or 2 to through traffic. Traffic through the Park would be a barrier to free flow of visitors and degrade the ambient environment and character of the Park. This decision would

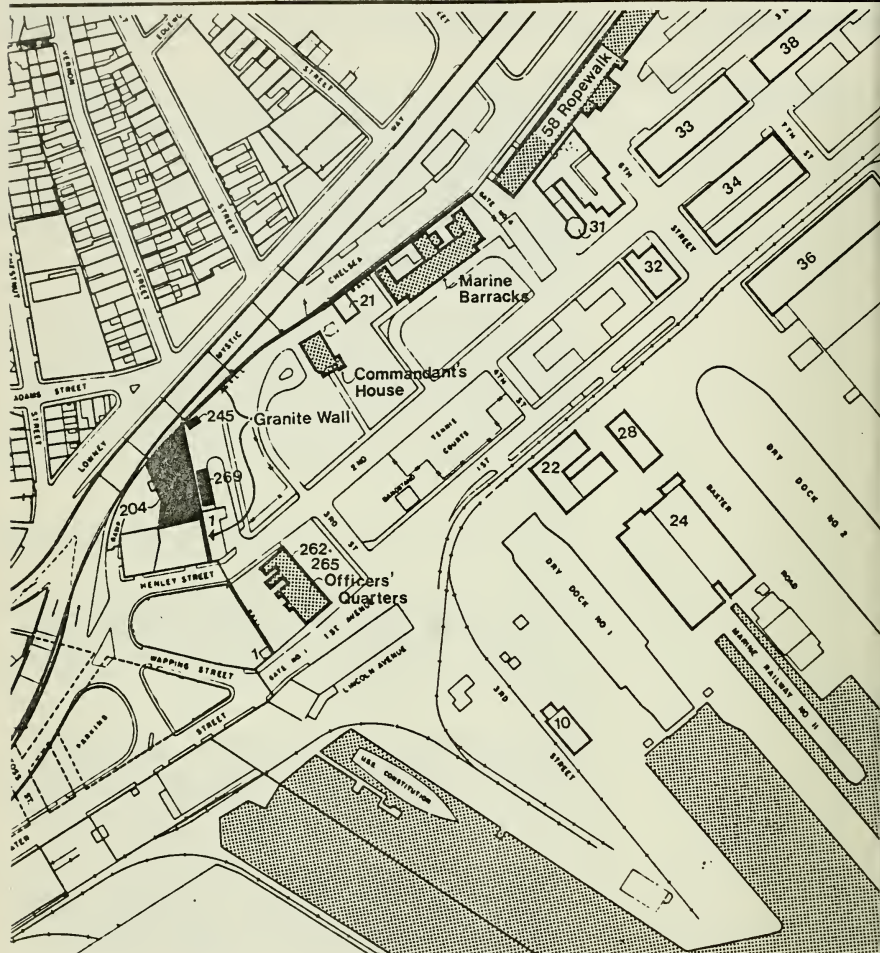
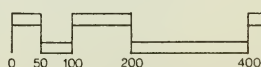


Figure 51

Affected Shipyard Structures

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58

Historically valued buildings
within the Shipyard

Historically valued buildings
principally affected by the
proposed improvement

Buildings demolished for the
proposed improvement

be counter to current stated National Park Service objectives.

Build Alternatives. The takings of land inside and outside the granite wall are shown by Alternative in Table 5.L-1 below:

Table 5.L-1 Shipyard Takings by Alternative (sq.ft.)

	Alt. 2	Alt. 2A	Alt. 3	Alt. 4
Inside Wall ¹	10,600	10,600	10,400 ⁴	12,700
Outside Wall ²	21,300	23,400	31,400	25,100
For Entrance ³	27,300	33,700	36,200	37,000
Total Sq. Ft.	59,200	67,700	67,600 ⁵	74,800
Total Acres	1.36	1.55	1.55	1.78

Alternatives 2, 2A, 4. Approximately 10,400 sq.ft. of land will be taken from between the Commandant's House and the granite wall marking the historic boundary of the Shipyard. Four hundred linear feet of the wall will be displaced and rebuilt on a new location. The relocated wall will be approximately five feet from the rear (formerly the front) steps of the house, reducing the lawn area and spatial openness. Buildings 204, 245, and 269 will be removed. Trees and other landscape material will be removed. The new road will reinforce the existing barrier effect of the Tobin Bridge and its approach. A sidewalk along the connector will permit pedestrian movement where there is none now. A new crosswalk at Gate 4 will provide access from the Shipyard to the community and Bunker Hill.

Alternative 3. There will be no permanent taking of land from the National Park. Approximately 10,400 sq.ft. of land will be used during construction of the tunnel, but will be returned when construction is complete. The 400 linear feet of the granite wall will be removed, but will be returned and rebuilt on their former site. The area will be re-landscaped in a suitable fashion. By putting the link underground, Alternative 3 will create a smaller visual and psychological barrier than the other Build Alternatives, but it will not provide greater access to the Shipyard for the pedestrian. A new pedestrian crossing at Gate 4 will still be possible.

Air quality and noise levels will be comparable to all Alternatives in 1995. Air quality will have improved and be slightly better with the Build Alternatives. Noise levels

1. This land is inside the granite wall (1825-26) on Shipyard property adjacent to the Commandant's House.
2. This land is outside the granite wall, but still is Shipyard property.
3. This land is not owned by the Federal Government, but was included in the Congressional authorization for possible acquisition and use for Park entrance purposes.
4. Temporary taking for construction.
5. Does not include temporary taking.

within the Shipyard will be approximately the same as existing levels for all Alternatives in 1995.

AGENCY COORDINATION

During the preparation of this Draft Negative Declaration there were several informational meetings with the State Historic Preservation Officer (SHPO) who is Director of the Massachusetts Historic Commission. Her office has been asked to review the preliminary document. The New England representative of the President's Advisory Council on Historic Preservation toured the Shipyard site on August 1, 1975, and has reviewed the design Alternatives. Correspondence from this agency appears in Chapter 8. Official 106 consultation procedures have begun.

M. Aesthetic Values and Visual Quality

The aesthetic and visual impacts of the Alternatives are discussed from the points of view of the motorist and pedestrian.

CRITERIA

The following criteria have been used to test the visual and aesthetic impacts of the Alternatives on the above areas of concern.

Physical Alteration: the compatibility of changes in the elements of the existing natural or man-made environment with the special character of the area.

Effect on Ambient Environment: changes in use or special character which make a particular area a valued resource.

EXISTING CONDITIONS

The visual experience in approaching the Shipyard at Gates 1 and 2 is confusing for both the pedestrian and the motorist. There is no orderly street pattern: the roadway and bridge elements are out of scale with the nearby buildings, which are of mixed residential and industrial scale. The landmark of the area, the U.S.S. Constitution, does serve to orient the visitor, but even it is partially hidden and looks quite small in relation to the highways and buildings around it. (See Figure 5m.)

These problems are compounded by the division between the Shipyard streets and the layout of surrounding roads. The Tobin Bridge was located in a manner which cut Chelsea Street into discontinuous pieces and created roundabout routes for the motorist and barriers to the pedestrian.

Once inside the Shipyard, the street pattern is orderly, and at the southern end there is enough land to give the visitor visual clues needed to move around without becoming lost.

There are a number of areas of particular concern which will be visually affected by the construction of the proposed improvement. Because of the future development of a National Park in the Shipyard, the view of the Commandant's House, the waterfront and the U.S.S. Constitution from inside the yard are of particular importance. Although Gates 1 and 2 will probably not be the main access to the Park, visual alteration of this traditional entrance is of interest.

The condition along Chelsea Street is important for the adjacent residential neighborhood, and there will be new views both of and from the proposed bridge. The entry condition at Gates 4 and 5 is also of interest because it is likely that these gates will be the main entrance to the National Park and the northern part of the Shipyard. The view from the roadway is primarily a matter of safety because of the complexity of the movements required of the motorist.

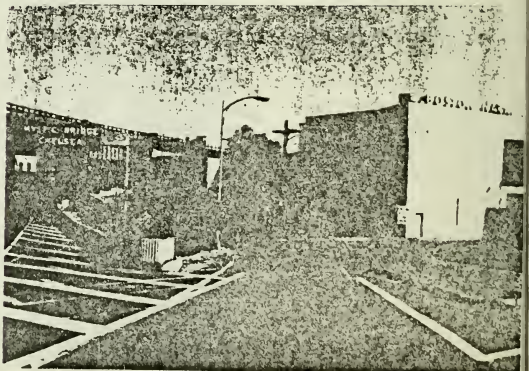
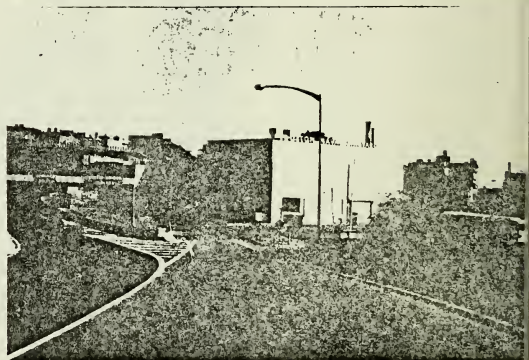
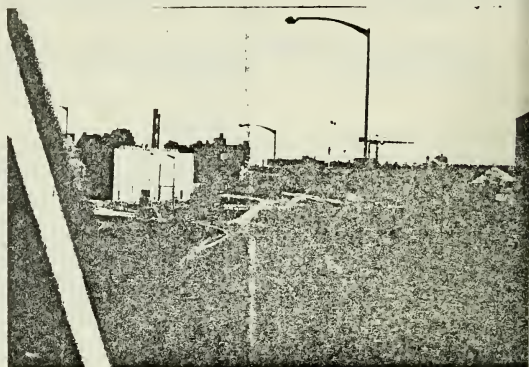


Figure 5m
Sequential photographs showing
the approach to the existing Water
Street off-ramp from the Tobin
Bridge Approach.

IMPACTS

No-Build. For Alternative 1, the No-Build, there will be no substantial change from the existing conditions, other than an increase in traffic, which will cause more congestion on Lowney Way, Medford Street, and Bunker Hill Street and more traffic on other local streets. It will result in a further degradation of the ambient (visual, audio and olfactory) environment in residential areas.

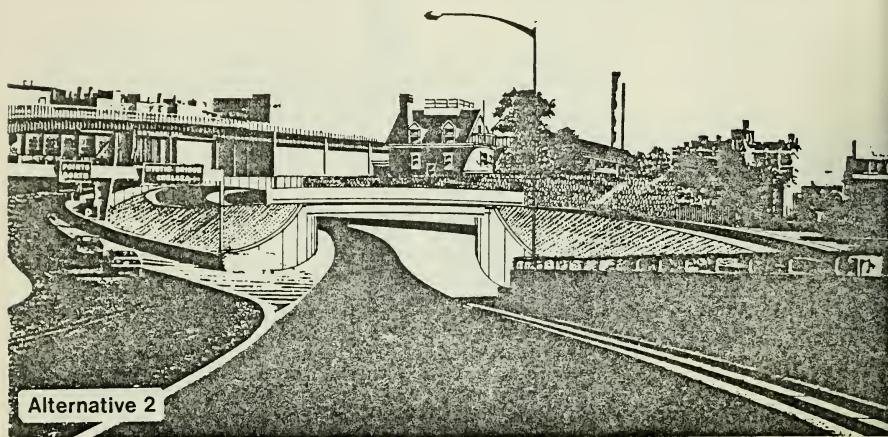
Little Mystic Channel Crossing. The bridge across the Little Mystic Channel is an element of each of the Alternatives. Its primary visual effect will be as an addition to the urban landscape. It will curve from Chelsea Street across the Channel to Terminal Street under the Tobin Bridge at a height of ten feet above mean high water, and visually contain the western end of the Channel, thus defining a new urban waterfront space for residents. The new bridge will be visible from Charles New Town Housing and from the Barry Playground in the foreground of the view of the Mystic Terminal and Tobin Bridge. For the driver, especially when southbound, there will be a new view of Charlestown from the low-level bridge.

Alternatives 2, 2A. Alternatives 2 and 2A are very similar in appearance (see Figure 5n), and are treated separately only where their impacts will be different. Between Gates 1 and 2 and the existing bridge approach nearly the entire area (now vacant and paved) will be used for the Water Street off-ramp and the roadway connecting Water and Chelsea Streets. The ramps will effectively move the expressway structure closer to the Shipyard boundary, within 50 feet at Gate 2.

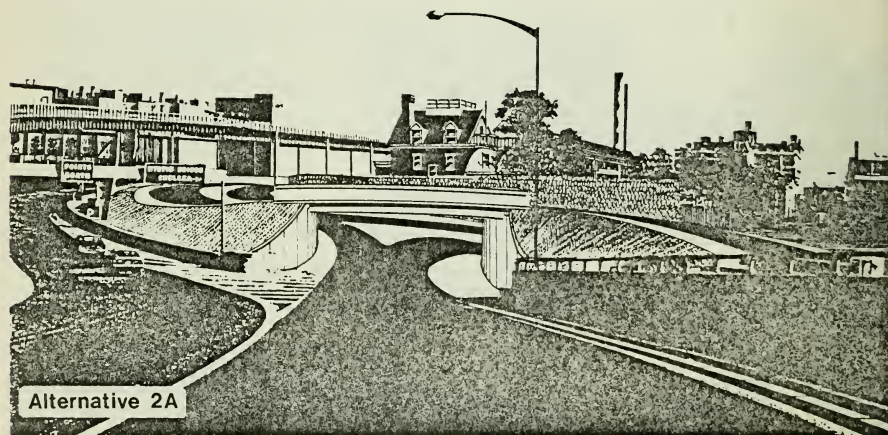
Whether the use of the land outside Gates 1 and 2 for roadways constitutes a conflict will depend upon the National Park Service's final plans for this area. The use of either of these gates as a main entrance would be awkward, but physically possible with Alternative 2. With Alternative 2A, it would be somewhat more difficult, but still possible.

In the area of the Commandant's House and the granite wall there will be physical takings of Shipyard property which are detailed in Table 5.L-1. A section of the orchard next to the house and approximately 400 feet of the granite wall will be taken. The wall will be rebuilt to separate the house and Shipyard from the new roadway, so that it can continue to act as a noise barrier.

The ten to twenty shade trees, shrubbery and lawn serve as an important landscape setting for the Commandant's House and this area of the Shipyard, making it appear more "residential". The vegetation also partially blocks the view of the Tobin Bridge to the west. Some of the trees would be replanted nearer to the house. The original house entrance would become virtually unusable.



Alternative 2



Alternative 2A

Figure 5n

Northbound Bridge Approach Exit Ramp

Seen from Position 2, Fig. 5m.

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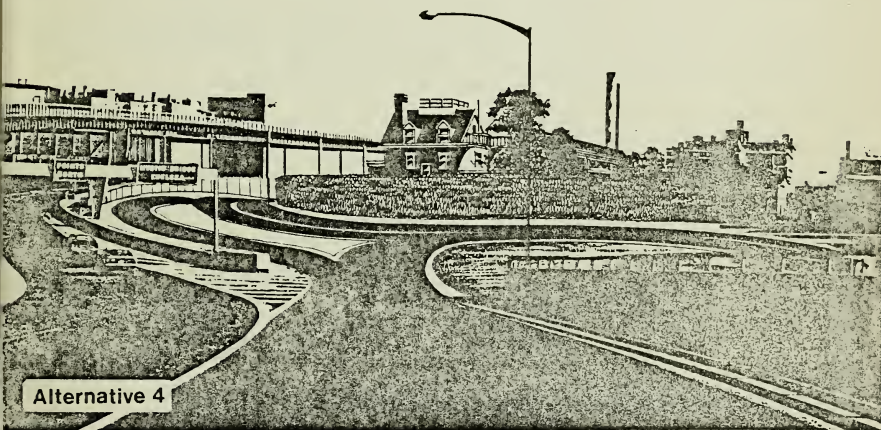
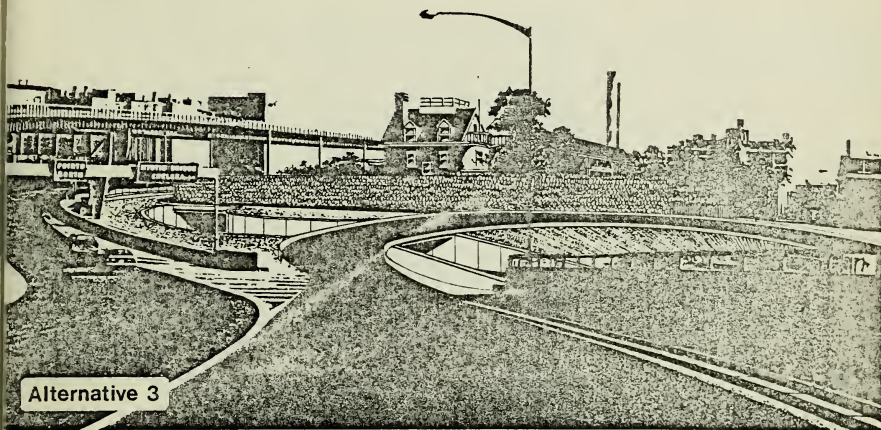


Figure 5n

Northbound Bridge-Approach Exit Ramp

Seen from Position 2, Fig. 5m

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Taking approximately 10,400 sq.ft. inside the wall would destroy the existing aesthetic relationship of the placement of the wall, the structure and its landscaping.

During the construction period, movement of the construction vehicles, and the use of jackhammers and piledrivers (if necessary) would create noise and air pollution and ground vibrations which may affect the foundation of the Commandant's House and the Marine Barracks or their interior and furnishings. Monitoring of these effects will be undertaken during construction and remedial measures taken if necessary.

The view from the road in Alternative 2A will have, in addition to the existing elements of a steep downgrade with a sharp right turn, a new left turn to join the northbound connector. These two "decision points" (one to exit from the bridge approach, and the second to turn right or left) are very close together and are likely to be confusing. Alternative 2 does not have the right turn and allows a smooth movement.

All Build Alternatives, by requiring the removal of Building 204, will expose to full view the Commandant's House, Marine Barracks, and granite wall. These will be visible at the same time as the U.S.S. Constitution to the motorist as he approaches the exit from the Tobin Bridge approach. The view of the waterfront and the U.S.S. Constitution will be improved by the new roadway.

Alternative 3. (See Figure 5n.) As in Alternatives 2 and 2A, the Gates 1 and 2 area will be used nearly entirely for roadway. Gate 1 will be usable only as an emergency entrance because of the amount of land taken by the tunnel approach and off-ramp. This visual impact will be somewhat less than with other Build Alternatives because the road link will be below grade.

The Commandant's House and granite wall will look much as they do today because the wall will be rebuilt on top of the tunnel and the area will be landscaped. The special look of settlement and age about an old wall and mature established trees will be lost for some years, however.

The view of the waterfront area within the Shipyard will not change. The view from the road as the driver exits from the bridge approach will include a steep down grade, the exit point on a left curve to the ramp itself which curves to the right and ends in a signal for a left turn on a free right hand turn. All Build Alternatives will re-establish some order to the street system by connecting two discontinuous streets. At the same time they will sharpen the definition of the historic edge of the Shipyard by removing buildings outside the wall and exposing the ancient granite to view.

Alternative 4. (See Figure 5n.) The aesthetic effects of Alternative 4 are quite similar to those of 2 and 2A except that since the Chelsea/Water Street connector is at grade, its visual impacts are much reduced. To the casual observer and the driver, available views of the waterfront and U.S.S. Constitution will be significantly improved.

The impacts of land, wall, and landscaping takings for construction and operation phases would be similar to the impacts of Alternatives 2 and 2A. Measures to minimize harm will be very similar for all Alternatives, although the environment at Gates 1 and 2 and along the wall will be more pedestrian-scaled with Alternative 4 than with Alternatives 2 and 2A.

5.N. Measures to Avoid and Reduce Impacts

5.N.1. No Build Alternative

Given the traffic volumes predicted for 1985 and 1995, traffic management techniques cannot be very successful in reducing impacts on residential areas or in providing good access for industrial and redevelopment uses.

5.N.2. Build Alternatives

Construction of the Build Alternatives affects city streets, historic resources of the Shipyard, public land, and one business. Some measures to mitigate these impacts will be implemented as part of construction; additional measures may be independently undertaken and funded by the BRA and/or NPS as urban design improvements. Both approaches are discussed below.

FHWA-FUNDED MEASURES TO AVOID & REDUCE IMPACTS

Highway associated measures to minimize impacts are essentially the same for all Build Alternatives, except in the National Park near the Commandant's House.

City streets and public lands affected by construction near Gates 1 and 2 of the Shipyard will be regraded, reseeded, and provided with new sidewalks, streetlights, and signalized crosswalks. The same thing will be done for affected properties along Chelsea Street. In addition, the abandoned bleachers in the MassPort easement on Boston Parks & Recreation Department property will be removed and the fence repaired. The bridge crossing, whether curved or straight, and its connection to Terminal Street will be improved in a similar manner as part of construction.

Relocation of the displaced business will be undertaken by MDPW if desired by the owner. See Chapter 5.K for details.

Construction Period: standard precautions will be taken during construction to minimize noise, dust, erosion, and disruption of traffic patterns. These measures include:

Staging and timing of construction will be planned to minimize traffic disruption.

Use of dikes to control bank erosion at the bridge abutments and adjoining areas.

Land disposal site for spoil materials from dredging Little Mystic Channel for construction of the bridge crossing or arrangements for disposal in the "Foul Area" at longitude 70 degrees 34.5'W and latitude 42 degrees 25.5'N.

Mats, dampening and other measures will be used to control dust generation at construction sites.

All equipment and procedures will conform to the City of Boston's ordinance regulating noise, air pollution and other aspects of construction operations.

At the National Park, measures to remove the cause of impacts or lessen their effect, will have to be developed in consultation with the FHWA, National Park Service, and the President's Advisory Council on Historic Preservation. See Chapter 5.L, Chapter 7 and Chapter 9 for more details.

Measures which are common to all Build Alternatives include precautions to prevent damage to the Commandant's House and/or Building #1. A careful investigation will be necessary in the final design phase to determine whether these structures will require protection during and/or after construction. A monitoring program may be recommended to protect construction vibration or settlement damage to these structures.

Other measures to reduce impacts will vary by Alternative as reported below:

Build Alternatives 2, 2A: in these two Alternatives it will be necessary for the roadway to use the land now occupied by an 1825-26 granite wall, formerly the boundary of the Shipyard. This wall will be moved, by cataloguing the stones, storing them, then rebuilding it as a buffer between the Commandant's House and the road. The wall cannot be restored to its original condition. However, its massiveness and ability to close off the yard will be retained.

Landscaping will be necessary to replace as many of the large trees as possible in order to recreate the tree screen which now graces the yard (see Appendix L for descriptions of the affected vegetation). It will take time for these trees to mature, but when they are grown, the view of the area from the main Park area to the east will not be noticeably different from today for the casual observer.

Landscaping will also be provided along Water Street on the banks of the ramp and roadway outside Gates 1 and 2. These plantings will soften the visual impact of the roadway and will be in harmony with the plans of the National Park Service and the BRA. In the same way, plantings should be provided in consultation with NPS and BRA at Gate 4 and along Chelsea Street. Chelsea Street will be repaired and given new curbs and sidewalks.

Build Alternative 3: the concept of a tunnel rather than an at-grade connector is an attempt to avoid the permanent taking of Park land and its associated impacts.

The wall and other significant historic structures taken for construction will have to be dismantled, but they can be rebuilt on the original site once the tunnel is completed. The mortar and vegetation will be new, but the relationship to the Commandant's House will not change.

Planting and the treatment of Gate 4 will be the same as that for 2 and 2A.

Treatment of the crosswalks will be the same as in Alternatives 2 and 2A.

The tunnel's open roof between the off-ramp and the granite wall would be fenced and perhaps covered with a grate to prevent accidents and vandalism.

Build Alternative 4: planting will be the same as for Alternatives 2 and 2A inside the Shipyard. Along Chelsea and Water Streets, this Alternative provides more opportunity for at-grade greenery.

Treatment of crosswalks will be similar to that for Alternative 2A.

URBAN DESIGN CONSIDERATIONS

While a number of measures to minimize impacts are included in construction expenditures, urban design studies suggest additional measures to enhance the potential aesthetic and economic benefits of the transportation improvements. Since these urban design proposals involve improvements outside the contractual limits of the highway corridor, "joint development" and other FHWA funds cannot be used. Design and implementation of urban design elements would have to be independently funded by BRA, NPS, and/or other parties.

These urban design studies explore one approach to enhancing the new Park for pedestrians, both resident and tourists to extending the open space of the Park and northern Shipyard redevelopment into the community; and to creating a suitable pedestrian entry to the Park for all visitors.

Urban design studies exploring landscaping, pedestrian path and Shipyard entrance treatments have been prepared for each Alternative. These studies show possible relationships between transportation improvements and known requirements of development plans for the northern Shipyard and the National Park (both still in the planning stage). Particular attention has been paid to avoiding roadway alignments which restrict entrance options to these new attractions.

Urban design suggestions for the treatment of Water Street, Gates 1 and 2, Chelsea Street, and Gates 4 and 5 are described below. Alternatives 2, 2A and 4 are generally similar and the descriptions distinguish Alternative 3 when the treatment is different. Figures 5p and 5q illustrate these suggestions applied to Alternative 4. Similar conceptual plans prepared for Alternatives 2, 2A and 3 are available in Appendix J.

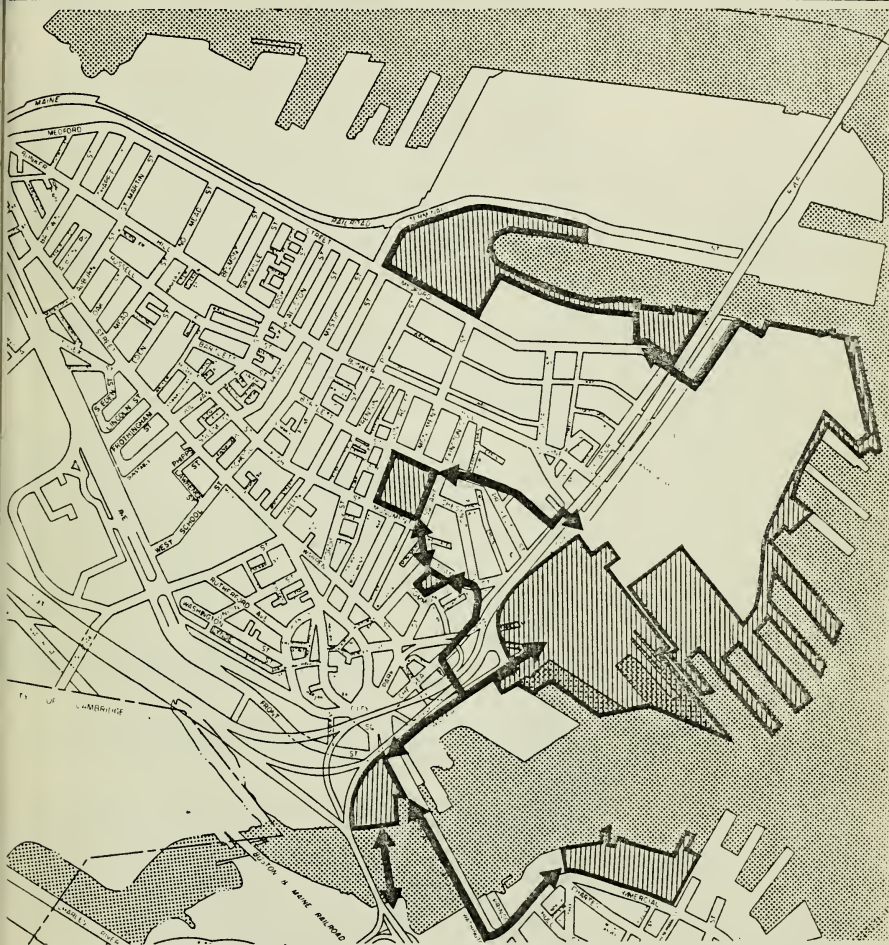
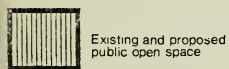


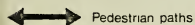
Figure 50

Pedestrian Waterfront Access and Tourist Walking Routes

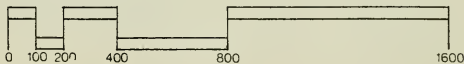
Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



Existing and proposed public open space



Pedestrian paths



Pedestrians. As shown in Figure 5r, several elements are already in place or planned, which could form a pedestrian loop from the Park to Bunker Hill, to Winthrop Square, to the Bunker Hill Pavilion and back to the Park. On a larger scale the planned Paul Revere Landing Park could be linked to the new National Park along Water Street, and a path could continue along the waterfront, through Gate 5 to Barry Playground and then over the bridge to Park land and the boat ramp on the Moran Terminal side of the Channel. The pedestrian walkways suggested in these urban design possibilities would contribute to the completion of this overall scheme.

Water Street. The sidewalk would be widened on the south side of Water Street and landscaped with street trees. A wider pedestrian way under the bridge approach would be provided in the building of the link would connect this walkway to the sidewalk at a signaled crossing.

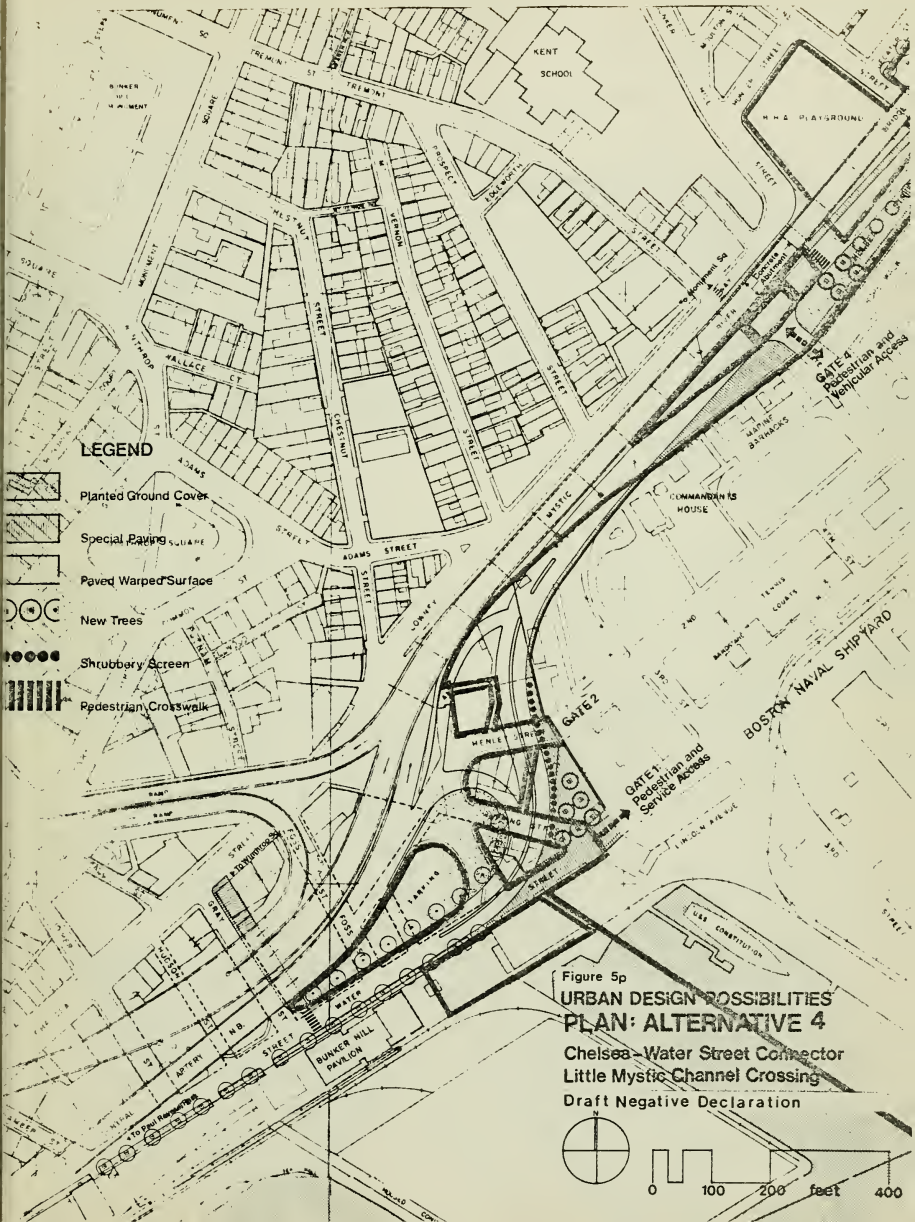
Gate 1. The widened sidewalk on Chelsea Street would continue into Gate 1. Pedestrians could also follow the walk along the Constitution. There would be access for service vehicles over the paved area for pedestrians to Gate 1. There would be a pedestrian walkway adjacent to the granite wall connecting Gates 1 and 4 along the connector. This sidewalk would be provided as part of each Alternative. Landscaping along the roadway and at the entrance would also be provided as a measure to reduce impacts.

In Alternative 3, Gate 1 would serve as pedestrian access and as a one-way entrance for emergency vehicles.

Gate 2. Although this gate would most likely be closed in all Alternatives, the option to open it for pedestrian access would remain.

Gate 4. Chelsea Street could be aligned differently than shown in the Alternatives by taking land from BHA owned area, not considered a 4(f), and keeping it immediately adjacent to the Tobin Bridge structure joining with existing Chelsea Street at Vine Street. This would allow more room at Gate 4 to create a suitable entrance for the Park and activities in the northern part of the Shipyard. The space could be used for planting, signs, special paving, and sight distance. Near Gate 4 there would be a signalized pedestrian crosswalk to connect the Park with pedestrian paths to Bunker Hill, to parking under the Tobin Bridge and to the community of Charlestown.

In Alternative 3, the link roadway would be below grade at Gate 4, creating an embankment, rather than a level area at the entrance. The sidewalk from Gate 1 and the crosswalk would remain.



LEGEND

Planted Ground Cover

Special Paving

Paved Warped Surface

New Trees

Shrubbery Screen

Pedestrian Crosswalk

Figure 5p

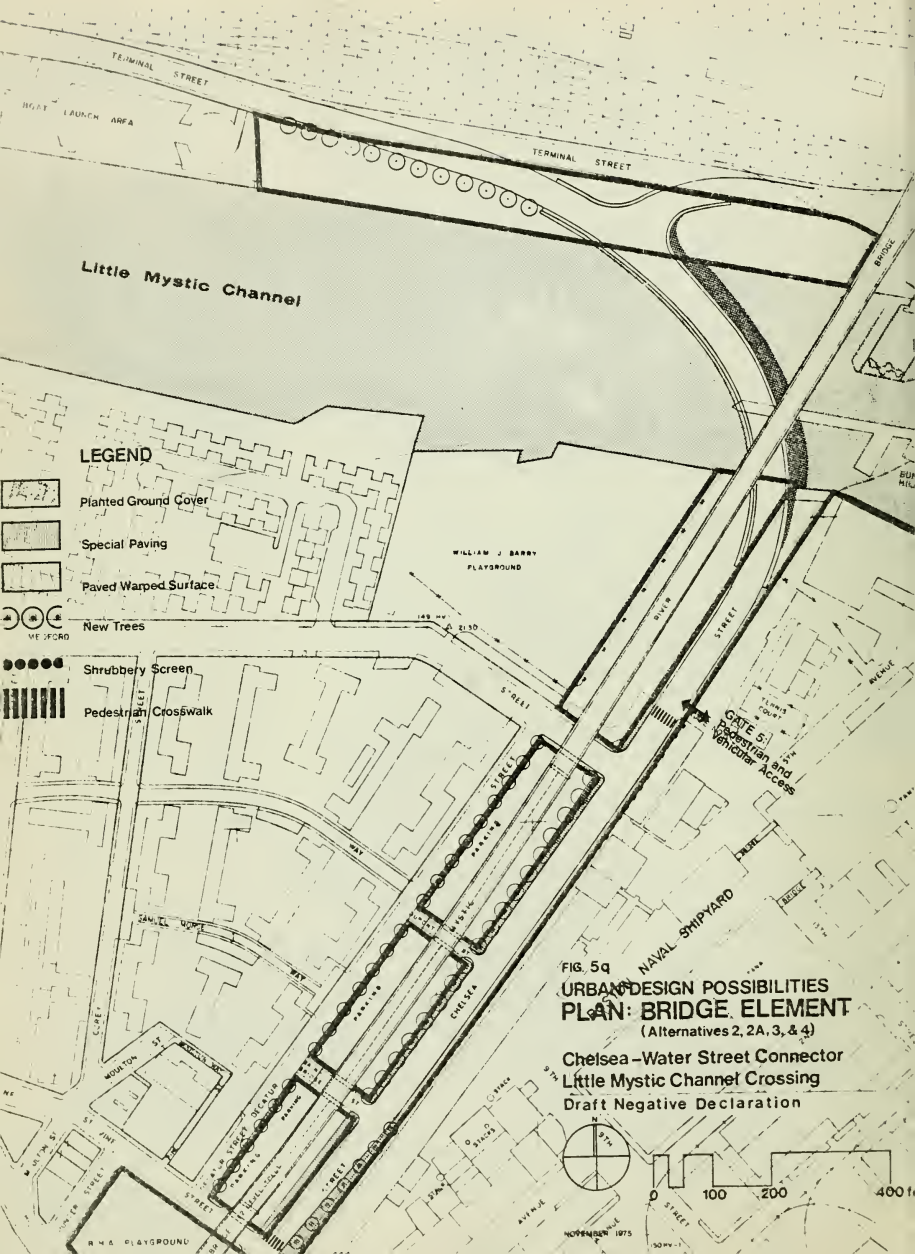
URBAN DESIGN POSSIBILITIES PLAN: ALTERNATIVE 4

Chelsea Water Street Connector
Little Mystic Channel Crossing

Draft Negative Declaration



0 100 200 feet 400



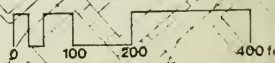
Little Mystic Channel

LEGEND

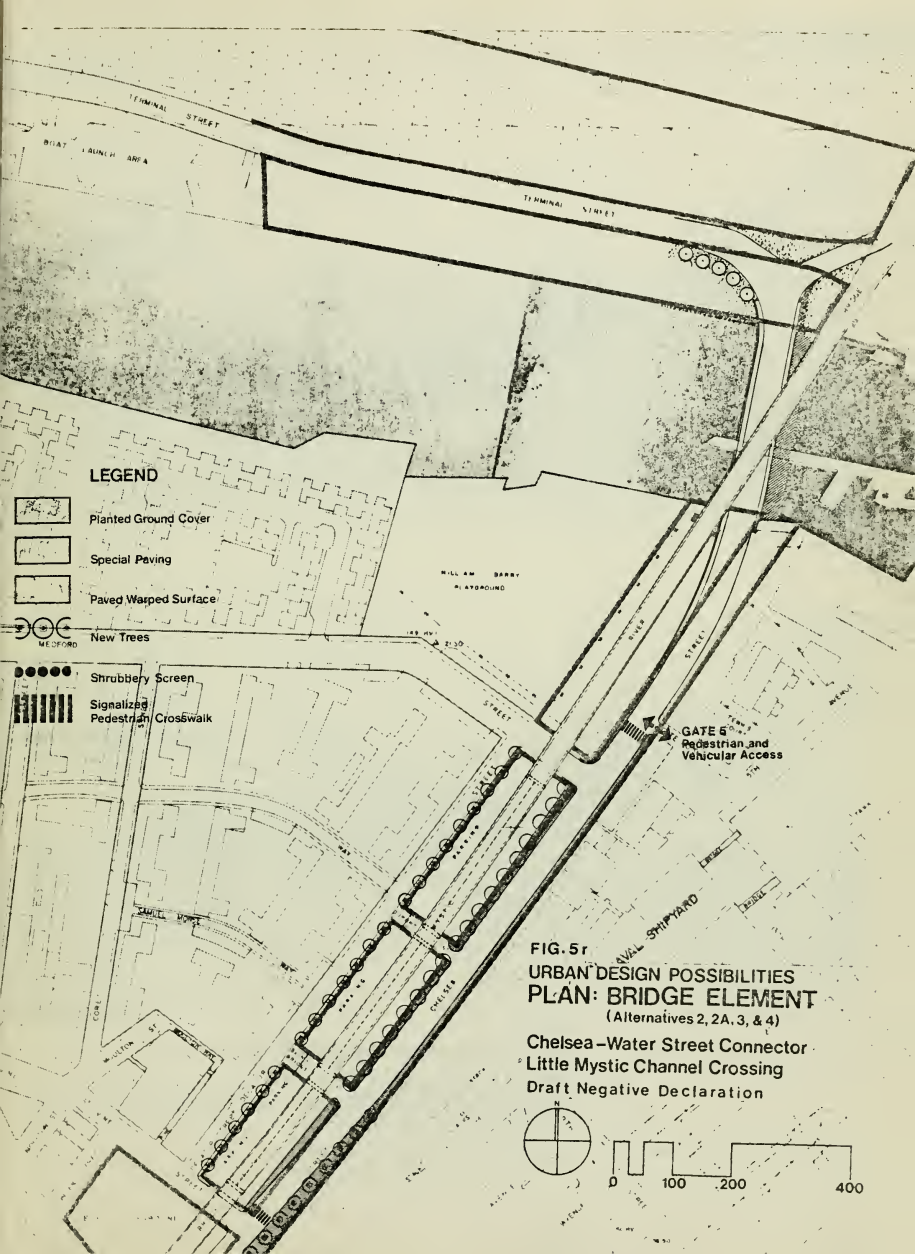
- Planted Ground Cover
- Special Paving
- Paved Warped Surface
- New Trees
- Shrubbery Screen
- Pedestrian Crosswalk

FIG. 5q
URBAN DESIGN POSSIBILITIES
PLAN: BRIDGE ELEMENT
(Alternatives 2, 2A, 3, & 4)

Chelsea-Water Street Connector
Little Mystic Channel Crossing
Draft Negative Declaration



NOVEMBER 1975



LEGEND



Planted Ground Cover



Special Paving



Paved Warped Surface



New Trees



Shrubby Screen

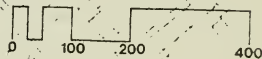


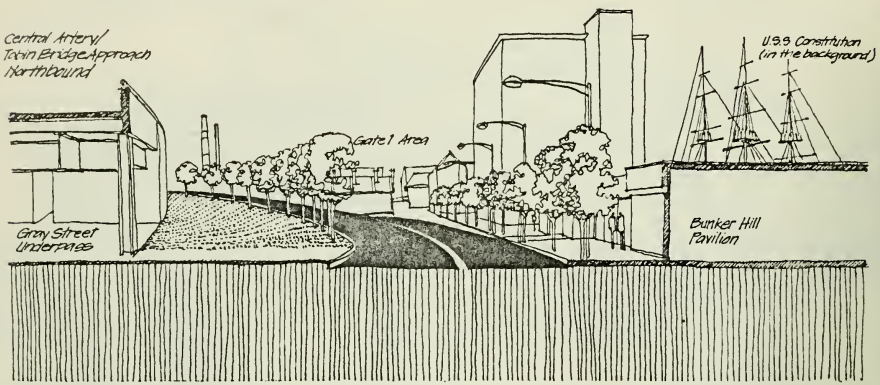
Signalized Pedestrian Crosswalk

FIG. 5r

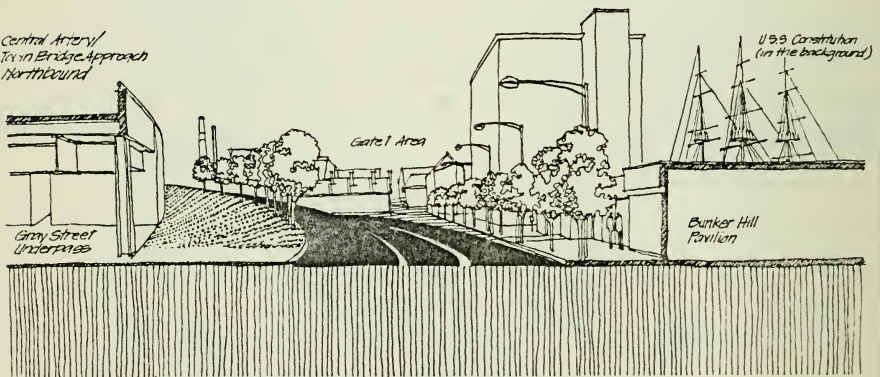
**URBAN DESIGN POSSIBILITIES
PLAN: BRIDGE ELEMENT**
(Alternatives 2, 2A, 3, & 4)

Chelsea-Water Street Connector
Little Mystic Channel Crossing
Draft Negative Declaration





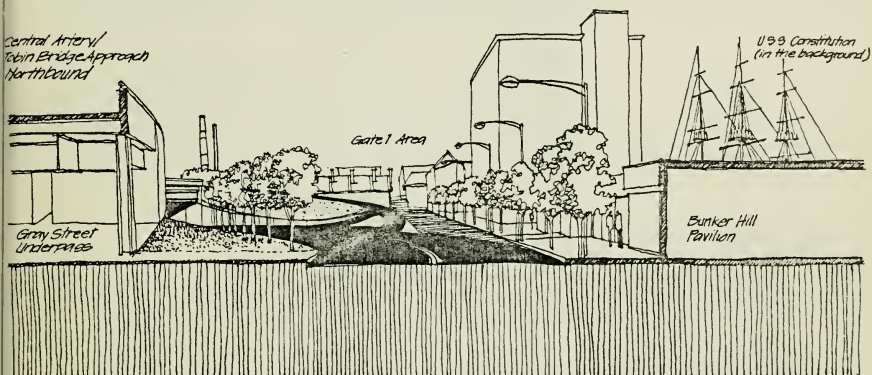
Alternative 2



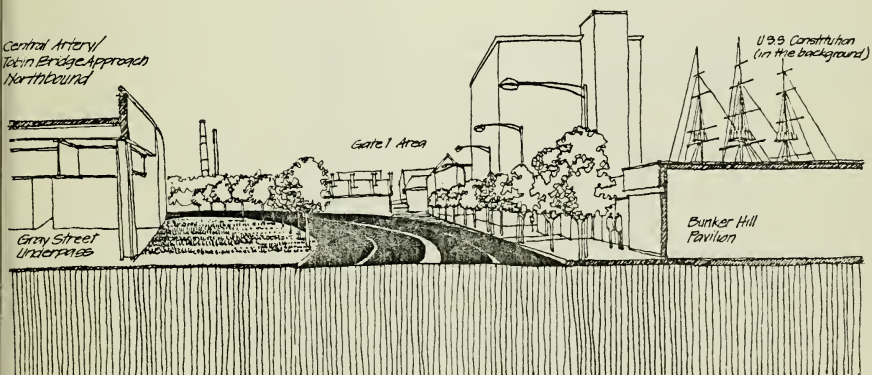
Alternative 2A

Figure 5s
Section through Water Street
Looking north toward Gate 1

Chelsea - Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



Alternative 3



Alternative 4

Figure 5s

Section through Water Street

Looking north toward Gate 1

Chelsea-Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration

Gate 5. There would be a signalized crosswalk at Gate 5 to connect the sidewalk to the northern Shipyard.

Chelsea Street. The realignment of the street would require the use of some Boston Housing Authority land between the existing street and the Tobin Bridge. The street would be repaved as part of the construction of the proposed project and a widened walkway provided on the parking lot side. The lots under the bridge would be landscaped and the small streets between them closed to traffic and used only for access to the parking lot. Bunker Hill Street would also be closed.

O. Unavoidable Adverse Impacts

Unavoidable adverse impacts include all negative impacts which are necessary consequences of following a given course of action and which cannot be significantly reduced through measures to minimize harm.

5.O.1. Transportation Service

The evaluation of unavoidable transportation impacts is based on the traffic increases projected for 1985 and 1995.

NO-BUILD

With this Alternative, traffic congestion and accidents will increase in the Lowney Way/east Medford Street corridor. Heavy trucking will continue and increase through and near residential areas making local movement difficult and unsafe as well as extending rush hours.

Reuse of the northern Shipyard will be severely constrained by lack of access. The National Park would suffer from difficult access and hard-to-reach parking under the Tobin Bridge.

BUILD ALTERNATIVES

All four Build Alternatives will require northern Shipyard traffic to go through Gates 1 and 5 during the construction period. The degree of disruption to National Park activities during this period will depend on the extent of redevelopment in the northern Shipyard, i.e., how much traffic is generated through Gates 1 and 2.

Alternative 2 does not have a southbound off-ramp which means motorists must make a loop to reach City Square, thereby using some of the connector's capacity. Alternative 4 must be signalized so that the northbound off-ramp is favored over the Chelsea/Water Street connector. By placing this serious capacity constraint on the connector, many of its potential benefits are lost.

5.O.2. Air Quality

NO-BUILD

Despite the greater numbers of slow-moving and stalled vehicles in an already congested corridor, air pollution levels will diminish through emission control strategies.

BUILD ALTERNATIVES

The four Build Alternatives represent a definite improvement in air quality over the No-Build Alternative because the congestion and pollution does not occur in residential areas.

5.0.3. Noise

No significant changes are anticipated under any Alternative because their contributions to noise levels are not significant compared to those of the Tobin Bridge. Construction period noise can be abated, but not entirely avoided.

5.0.4. Water Quality

No unavoidable adverse impacts are expected.

5.0.5. Vegetation and Wildlife

Shrubbery, grass and a number of trees would be removed for the Build Alternatives. As no rare species of flora or fauna are involved, the major adverse impact will be the reduction of habitat and landscape area within the Shipyard wall; approximately $\frac{1}{4}$ acre is involved.

5.0.6. Social

No direct adverse social impacts are anticipated with any Alternatives under study. However, the No-Build entails worsening environmental conditions for residential areas. By contrast, the Build Alternatives result in an improved environment by allowing heavy trucks to bypass residential areas.

5.0.7. Economic

NO-BUILD

The major negative economic impact of this Alternative lies in the constraints it imposes on growth of activity at the Moran Container-port and upon reuse of the northern Shipyard. Potential jobs, income, and tax revenues are also foregone.

BUILD ALTERNATIVES

No adverse impacts are anticipated except for displacement of a tavern on Chelsea Street. The loss of tax revenue is expected to be more than offset by revenues from proposed Shipyard reuses and jobs generated by construction.

5.0.8. Public Facilities

NO-BUILD

No adverse impacts are anticipated on existing facilities and services except insofar as traffic increases projected for 1985 and 1995 would make access to BHA playground areas more hazardous.

BUILD ALTERNATIVES

The build alternatives improve residential access to the Barry and BHA playgrounds.

The curved bridge alignment takes approximately 4,200 sq.ft. from an unused area attached to the Barry playground. The straight bridge alignment takes approximately 5,800 sq.ft. from the same unused area attached to the Barry playground. In both bridge alternatives, use of the public boat ramps on the Little Mystic Channel will be limited by the 10-foot underclearance of the new bridge.

5.0.9. Historic and Cultural Resources

NO-BUILD

No existing resources are directly affected.

BUILD ALTERNATIVES

The major unavoidable adverse impact of Alternatives 2, 2A, and 4 is the taking of approximately 1/4 acre inside and 3/4 acre outside the historic Shipyard. While the effect upon the character of the Shipyard is mitigated by reconstruction of the granite wall and re-landscaping and better views of the property, its area is reduced.

The adverse historic impacts of Alternative 3 occur chiefly during construction of the tunnel. The Shipyard wall can be reconstructed and landscaping replaced, except for a few large trees, after the tunnel is completed.

5.P. Short-Term vs. Long-Term Productivity of the Environment

The decision to implement the No-Build or one of the Build Alternatives will in part be based on a comparison of their short- and long-term uses of environmental resources. These impacts are briefly discussed below and summarized at the end of this section.

5.P.1. Short-Term Impacts

NO-BUILD

By definition, Alternative 1 has no short-term impacts.

BUILD ALTERNATIVES

The Build Alternatives have short-term impacts associated with construction including: dust, noise, silt and removal of vegetative cover as well as temporary rerouting of traffic. However, most of these effects will occur on the east-tern, non-residential side of the Tobin Bridge.

All four Build Alternatives take the southwest corner of the Shipyard during the construction period.

Public monies from a limited yearly allocation will be expended for this project and generate a number of short-term construction jobs and induced activity. Giving this project priority may thus defer street improvements in other areas of Boston.

5.P.2. Long-Term Impacts

Implementation of any Alternative affects elements of the Charlestown environment which influence its long-term productivity and richness in several categories of interest:

TRANSPORTATION SERVICE

Free-flowing traffic, easy access, and parking enhance long term opportunities for economic growth.

No-Build. This Alternative will lead to increased congestion on existing truck routes and in residential areas as well as inhibiting full redevelopment of the Shipyard.

Build Alternatives. The Build Alternatives provide much better traffic service and access than the No-Build. Moreover they effectively separate local residential traffic from industrial, commercial, and a substantial proportion of tourist traffic.

NATURAL ENVIRONMENT

No-Build. Air quality will improve through the implementation of federal and state regulations. Noise characteristics will not change significantly. Water quality, vegetation, and wildlife will not be significantly affected.

Build Alternatives. The Build Alternatives provide slightly better air quality than the No-Build, particularly in residential areas. There is no significant difference between Alternatives in terms of noise or water quality. While the Build Alternatives take more vegetation than the No-Build, they involve re-landscaping the affected area of the Shipyard and offer the opportunity to landscape a now barren corridor along Chelsea and Water Streets.

HUMAN ENVIRONMENT

No-Build. The No-Build Alternative is a constraint upon long-term economic growth of Charlestown as well as a limit to its achievable quality of life. Heavy truck traffic is not encouraged to use non-residential streets. Since the northern Shipyard and National Park will suffer from insufficient access to the arterial street and expressway system, new job opportunities will be reduced.

Build Alternatives. By contrast, all four Build Alternatives route heavy traffic away from residential areas while providing significantly improved access to existing industrial uses, the northern Shipyard, and the National Park. Residential quality and street safety are improved while opportunities for sustained long-term economic development and job generation are enhanced. The Build Alternatives also displace a small business and take varying amounts of public land.

Alternatives 2, 2A and 4 permanently take approximately $\frac{1}{4}$ acre inside the historic Shipyard. The historic aspect of the interior of the Shipyard will be permanently affected. Alternative 3 has no permanent impacts inside the Shipyard. A BRA/NPS land swap may be possible near Gates 1 and 2 which would benefit the Park.

CONCLUSION

By separating residential from industrial and commercial traffic, the Build Alternatives contribute more to enhancing and maintaining the long-term productivity of the Charlestown environment than the No-Build. Their short-term impacts are not severe and confined to non-residential areas. These benefits are achieved at the cost of modifying a historic cultural resource and assigning this project priority over traffic improvements in other areas of Boston.

5.Q. Irreversible and Irretrievable Commitments of Resources

In urban areas, construction of new transportation facilities often requires permanent displacement of some existing feature of the landscape. It is only proper that we should be concerned lest any project displace something of greater value than its traffic benefits. This concern takes two forms:

First, would the transportation facility displace, destroy, or irreparably damage some unique natural or cultural resource? For example, part of the historic significance of a resource may lie in its location. To occupy that specific site with something else would be, for all practical purposes, an irretrievable commitment of resources.

Second, can the effects of a project be reversed, i.e., can the environment be restored to its original conditions if the completed project were removed? In theory, most uses of the environment are reversible. Given enough effort, time, money, and other resources the least vestiges of any project can be eradicated and the environment returned to its original conditions. In practice of course, this option is rarely exercised or only in part when particularly valuable resources are affected.

Given the historic significance of the Shipyard and the relative permanence of transportation improvements, the nature of the commitment of historic and cultural resources becomes a significant consideration.

5.Q.1. Immediate Uses of Resources

NO-BUILD

Alternative 1 involves no changes in the existing environment.

BUILD ALTERNATIVES

The planning of Alternatives 2, 2A, 3 and 4 already involves a commitment of human effort, funds, and time by public agencies, concerned citizens, consultants, etc. Any Build Alternative will also require commitments of construction materials, public funds, and of existing public streets, land and property for right-of-way; these would be lost to other foreseeable uses.

Alternatives 2, 2A, and 4 use a corner of the Shipyard for their right-of-way. In theory, this is not an irretrievable or irreversible commitment of resources, since this corner of the Shipyard could be returned to its existing condition after demolition of the proposed improvements. In practice an either/or situation exists and a decision will have to be made whether the traffic benefits outweigh alteration of a significant historic resource. See Chapter VII, Section 4(f) Review and Chapter 8, Section 106 Review for full details.

5.Q.2. Future Commitments

NO-BUILD

Alternative 1 represents commitment to maintenance and repair of existing facilities as well as traffic management measures if traffic increases as predicted. It also implies a judgement that the potential benefits of economic growth and separation of residential and industrial uses in Charles-town are not worth major public investments at this time. However, the No-Build Alternative provides the option of making transportation service or other improvements at any time in the future.

BUILD ALTERNATIVES

Alternatives 2, 2A, 3 and 4 involve an irretrievable commitment of public funds to the repair and maintenance of a new transportation facility as well as to facilitating the economic growth of the region and to human benefits of separating residential and non-residential transportation routes.

These alternatives also reflect a public commitment to motor vehicles as the basic form of personal and freight haul transportation. However, a curved alignment of the Little Mystic Channel Bridge has been studied to allow a railroad bridge to link facilities in Moran with those in the northern Shipyard, if the need arises. The straight alignment of the bridge forecloses the possibility of future rail links.

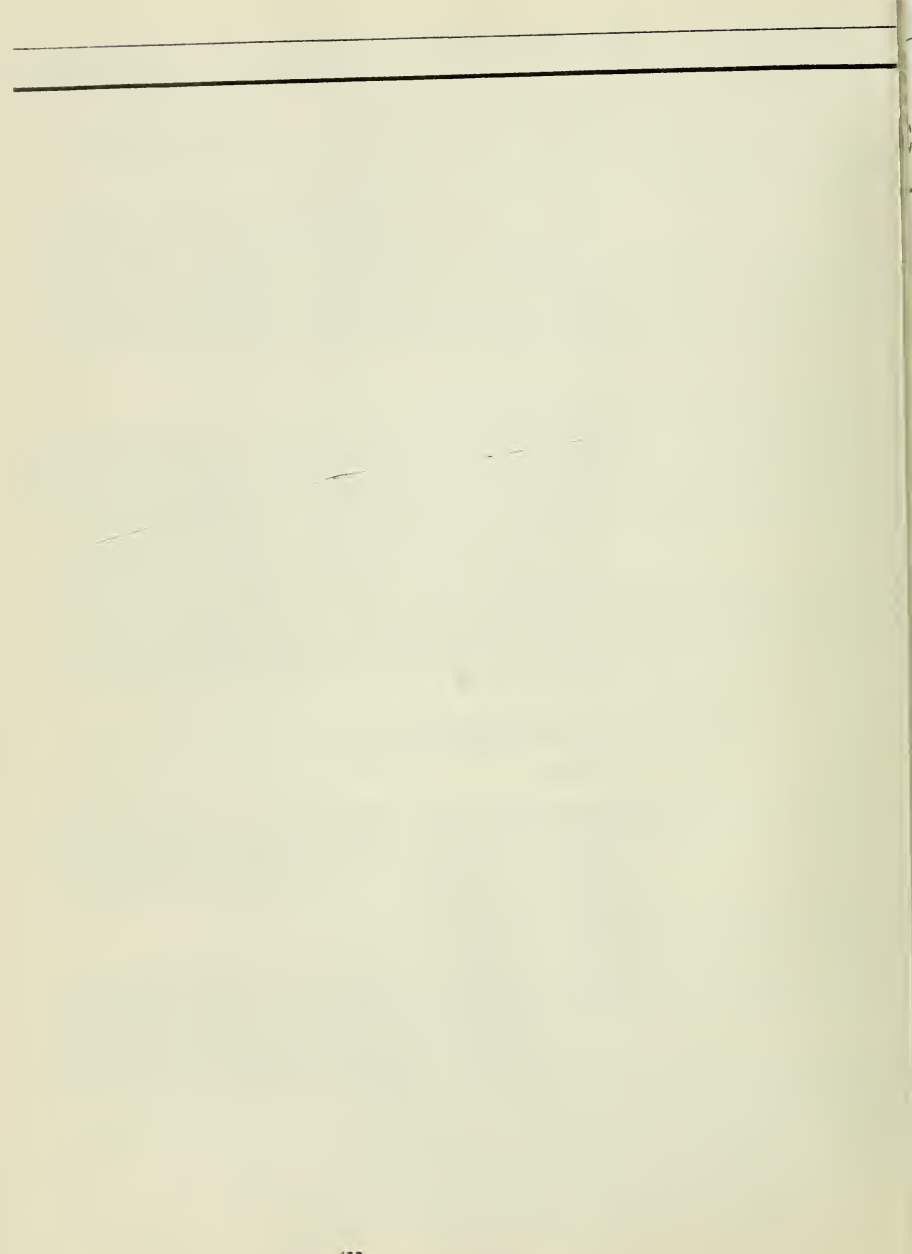
5.Q.3. Secondary Effects

NO-BUILD

The secondary effects of Alternative 1 are the restraints upon economic growth, Shipyard reuse, and residential amenity imposed by traffic congestion and poor parking and access conditions. They are only reversible by constructing the proposed improvements.

BUILD ALTERNATIVES

The Build Alternatives are expected to facilitate reuse of Shipyard facilities, increase access to the National Park and serve Moran Terminal expansion. These activities are expected to generate substantially increased jobs, income and tax revenues in the future. They will also lead to an improvement in the environment of nearby residential areas.



Chapter 6

Public Involvement

The Department of Public Works held four public meetings in Charlestown during the preparation of the Draft EIS. Each meeting was announced twice in the local paper, The Charlestown Patriot, as well as in mailings to community leaders and people who had attended previous meetings. The sessions were conducted at the Kent School, Bunker Hill Street, at 7:30 p.m. on June 5, July 17, September 3, and October 30. An average of 40 people attended, 23 of them not connected with Government agencies.

Background material and an agenda were distributed at each meeting and mailed out in advance. In addition, a summary of questions asked and answered at the previous meeting was made available at the meetings. Comment sheets were always available; a number were received in the course of the Study. They are on file at the BRA.

During the meeting the consultant team presented for discussion the issues of the Study and the decisions which had been made in the period between meetings. The Alternatives were thoroughly presented and the traffic projections and other impacts were discussed. Major comment concerns expressed by people at these meetings include:

1. Would the new traffic pattern make it more difficult for Charlestown residents to get around in their community? No - it will be easier.
2. Would the trucks and other through traffic actually be noticeably reduced on Medford Street and Lowney Way? Yes - quite a large reduction in numbers of heavy trucks is projected.
3. Would the whole project be coordinated with the proposed improvements in City Square? Yes - the two work together.
4. What is the EIS process and how can Charlestown residents participate? - Answered at meetings.
5. Would pedestrian access in the area, and particularly to the waterfront, be increased? Yes - by crosswalks and signals.
6. Would new traffic be kept off Decatur Street? Yes - because it would have no incentive to use it.
7. Would there be any residential takings? No - all the improvements occur in non-residential areas.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
ENVIRONMENTAL SECTION

Public Meeting, Traffic Improvements, Charlestown.

This sheet is provided for your comments. We welcome your concerns and opinions on the material which has been presented.

Please return your sheet to a staff member at the meeting, or mail to:

Mr. Walter Brooks
Transportation Planning Office
Boston Redevelopment Authority (BRA)
Room 915, City Hall, Boston, Massachusetts 02114

With respect to Charlestown Traffic Improvements, The Boston
Shipping Association, Inc., representing a majority of the
commercial marine operation interests at Boston, fully
supports recommendations by the Boston Redevelopment Authority,
i.e., 1. A new bridge across the Little Mystic Channel,
2. Connection of Chelsea Street and Water Street
3. Relocation of the north bound Tobin Bridge off ramp, and
4. Close Medford Street and Lowney Way to trucks.

THE-BOSTON SHIPPING ASSOCIATION, INC.

7/1/77
Robert M. Calder
Executive Director

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
ENVIRONMENTAL SECTION

W. Brooks
RECEIVED

JUN 10 1975

TRANSPORTATION
PLANNING DIVISION

Public Meeting, Traffic Improvements, Charlestown.

This sheet is provided for your comments. We welcome your concerns and opinions on the material which has been presented.

Please return your sheet to a staff member at the meeting, or mail to:

Mr. Walter Brooks
Transportation Planning Office
Boston Redevelopment Authority (BRA)
Room 915, City Hall, Boston, Massachusetts 02114

This material is well presented and reasonably comprehensive. One has the feeling that at long last the habit of shrugging off Charlestown is coming to an end. There is the corresponding point that people do exist here who can evaluate and expand upon substantial, involved ideas.

There is a major omission in the presentation which, I assure you, can wreak havoc in two directions. It will not be possible to clarify most of the issues you refer to until the plan for City Square has been substantially worked out, as well. At a recent meeting on that subject, two possibilities were offered both of which had monumental difficulties with respect to satisfactory treatment of traffic flow and of local civic development.

We do not intend to sit idly by dealing with one problem while a solution is being imposed upon us of another which is intricately linked to the first.

At the moment it appears to me that your proposed task area should take possible precedence over City Square, but only with the clear understanding that the latter will then be considered in similar fashion and proper merger of the two sought thru major mutual adjustments if necessary.

Douglas P. Adams
58 Monument Avenue
Charlestown, Mass 02129

Chapter 7

Section 4(f) Review

7.A. Description of Alternatives

The proposed improvement consists of a roadway to connect Chelsea and Water Streets and a bridge to link Chelsea Street and Terminal Street across the Little Mystic Channel in the Charlestown district of Boston. These connections will provide routes for traffic which will remove trucks and many autos from local streets, provide better access to industrial areas, and enable the National Park Service to close the former Boston Naval Shipyard to through traffic in accordance with their plans for a national park site.

There are four alternative designs for the roadway, one bridge design, and a no-build option.

Refer to plates 1-5 located at the end of Chapter 8 for detailed drawings of the Alternatives.

ALTERNATIVE 1

No-Build. The road system would remain as it is today.

ALTERNATIVE 2

Divided At-Grade Link, Northbound Off-Ramp Only. The connector would be split northbound and southbound between Gray Street and a point west of the Commandant's House. The off-ramp from the Tobin Bridge approach would pass under the southbound connector roadway and would merge with the northbound connector lanes.

ALTERNATIVE 2A

Divided At-Grade Link, North and Southbound Off-Ramp. This design is the same as 2, but provides a southbound turn on to Water Street toward City Square from the off-ramp.

ALTERNATIVE 3

Tunnel Link, North and Southbound Off-Ramp. The link, in the same corridor as 2 and 2A would be in a tunnel from Henley Street to just north of the Commandant's House. A circular off-ramp will pass over the portal of the tunnel and will intersect with the connector south of the portal. Both north and south turns would be permitted.

ALTERNATIVE 4

Undivided At-Grade Link, North and Southbound Off-Ramp. The north and southbound lanes of the roadway would not be separated. The off-ramp would intersect with the link at-grade; both north and south turns would be permitted.

7.B. Boston National Historical Park: Boston Naval Shipyard Site

SIZE AND LOCATION

Approximately 29 acres (21+ of land and 7+ of water) of the former Boston Naval Shipyard have been set aside for one site of the multi-site Boston National Historical Park. The land is on the waterfront in Charlestown between the Little Mystic Channel and the Charles River. The Tobin Bridge separates the yard from the rest of the community. The planned Park site is at the southwest end of the yard and includes the Commandant's House, the U.S.S. Constitution and the main entrance to the yard at Water Street (see Figure 8a).

TYPE

Historic and park land. This property has been designated for development as a National Historical Park by Congress. It is listed (as part of the Boston Naval Shipyard) on the National Register of Historic Places. A Section 106 report is attached to this Draft Negative Declaration.

AVAILABLE RECREATIONAL ACTIVITIES

When the Park is open it will provide visitors the opportunity to see historic industrial buildings, a museum containing artifacts of the yard and the U.S.S. Constitution, films and other exhibits, as well as to experience the historic environment of the Park. The U.S.S. Constitution will continue to be berthed on the site and to be open to visitors.

FACILITIES

Existing buildings will be rehabilitated for Park use. There will be a visitor-information facility, the Constitution, Dry Dock 1, and historic buildings to be viewed on a self-guided basis. The Commandant's House will be part of the historic background. Further information appears in the National Park Service's Boston Naval Shipyard: An Alternative for Development, March, 1975.

USAGE

The U.S.S. Constitution is one of the most popular tourist sites in Boston. In 1972, 637,000 people visited the ship; 855,000 are expected to visit by the end of 1975. When the Park is open, this study projects visits will reach 1,000,000 by 1980.

RELATIONSHIP TO SIMILARLY USED LAND

This land is a historic Shipyard site. No other east coast shipyard, (Norfolk, Newport, or Portsmouth), is being made into a national park. Shipyard land not included in the Park boundaries is now being planned for development associated with the Park: museums, retail, commercial, restaurants,

motel and other tourist-related uses. The Bunker Hill Pavilion located nearby presents the history of Charlestown and the battle at Bunker Hill in Charlestown.

ACCESS

The Park can be reached from the following Expressways: I-93 Southbound (Water Street ramp), Central Artery Northbound (Water Street ramp), Northeast Expressway Southbound (Henley Street ramp). Local traffic must pass through City Square to Water Street to enter at Gate 1. Access to the area set aside for the Park is now through Gates 1 and 2. The National Park Service wishes to close these gates to through traffic to enhance the park environment. This action will create the need for access to the remainder of the Shipyard in addition to the need for parking and entry to the park itself. The alternatives presented here are designed to provide access from the expressway and from local streets to Gates 4 and 5 of the Shipyard. These gates may be used by both the park and northern part of the yard. Correspondence from the National Park Service's Regional Administrator is attached.

OWNERSHIP

U.S. Government General Services Administration to be transferred to Department of Interior January 1976.

DEED RESTRICTIONS

Not known, NPS has stated it will not sell, but rather lease any land required for road improvements.

UNUSUAL CHARACTERISTICS

In addition to its importance as a shipyard, the Yard is the site of Moulton's Point, where British soldiers landed to make their assault on Breed's Hill in 1775.

The following information has been excerpted from the National Park Service's Boston Naval Shipyard, An Alternative for Development, March 1975:

"The primary purpose of the proposed national historic site is to provide for the interpretation of the historical development of the yard, of the U.S. Navy, and of the U.S.S. Constitution. Administrative and maintenance functions will be required for the shipyard and the Constitution. The U.S.S. Constitution Museum Foundation, Inc. will provide a museum and sales facility, as well as services supporting the Constitution and the National Park Service. The grounds will serve as a setting for interpretation, and also provide passive recreation for the visitor.

Four primary use-functions can be identified at the

proposed national historic site: the entrance area; the visitor-use area; the support facilities area; and the administration area.

The organization of these uses in the most desirable arrangement relative to existing facilities is important to ensure a pleasant visitor experience, and to ensure functionality. The primary visitor experience at the park will be the actual boarding of the U.S.S. Constitution. She will be restored to "fighting trim," as though ready to put to sea in defense of her country. U.S. Navy seamen dressed in period uniforms will provide guide and information services on board.

It is proposed that parking not be provided within the boundaries of the park, except for limited administrative parking. This exclusion of parking will serve to keep the boundary of the park as compact as possible; thus, maximum commercial and industrial re-use of the remaining portion of the shipyard can be allowed, which will allow maximum acreage to be added to the city tax roll, and provide the greatest potential for jobs, to offset the large loss of jobs resulting from the closure of the base.

The Park Service is considering Quarters G (the Commandant's House) for exhibition because its architectural features, furnishings of former occupants, and paintings are of historical interest. The Park Service will find appropriate uses for related structures such as: 1 (the entrance gate and garage); 2 (the carriage house); and 245 (a garden shed).

It is the intention of the National Park Service to close Gates 1 and 2 to all vehicular traffic with destinations in the industrial portion of the shipyard as soon as alternative access can be provided. The historic park setting and the projected visitor-use patterns necessitate that this incompatible use be eliminated. The closure of Gates 1 and 2 to through traffic will necessitate some alternate access routes to the remaining portion of the navy yard, to ensure that full and economically viable reuse of the yard can take place.

The National Park Service appreciates and has been sensitive to the need for adequate access to the remaining portion of the shipyard, and also appreciates the community of Charlestown's desire to eliminate trucking traffic from their streets. Members of the National Park Service have been meeting for some time with city, state, and community groups to explore the potential solutions to these problems."

LOCATION AND AMOUNT OF LAND TO BE USED BY THE HIGHWAY

Takings have been divided into three categories: the land inside the granite wall which has been part of the shipyard since the building of the Commandant's house; land which was later acquired by the Navy, but is outside the wall; land around Gate 1 to create an improved entrance, as authorized by Congress. Planning for the Park is not yet complete and it is possible that some land which was authorized for acquisition may not be required for park purposes.

The land takings for each alternative are detailed in the chart below. The tunnel in alternative 3 will require the land inside the wall during construction only. When the tunnel is closed over the land will be restored to the Park Service.

Table 7.B-1 Shipyard Takings by Alternative (sq.ft.)

	Alt. 2	Alt. 2A	Alt. 3 ⁴	Alt. 4
Inside Wall ¹	10,600	10,600	10,400	12,700
Outside Wall ²	21,300	23,400	31,400	25,100
For Entrance ³	27,300	33,700	36,200 ⁵	37,000
Total Sq. Ft.	59,200	67,700	67,600	74,800
Total Acres	1.36	1.55	1.55	1.78

FACILITIES AFFECTED

Three buildings will be removed in all the Build alternatives: 204, a garage and maintenance shop built in 1942 outside the granite wall; 245, a woodframe gardener's shed built in 1929 inside the corner of the granite wall; and building 269, a brick garage for officers cars built in 1941.

All the Build alternatives will also require the dismantling and rebuilding of the granite wall built in 1825-26. The wall is made of very large stone blocks in ashlar coursing and marked the original boundary of the Shipyard. The National Park Service intends it to be part of the backdrop with the Commandant's house.

1. This land is inside the granite wall (1825-26) on Shipyard property adjacent to the Commandant's house.
2. This land is outside the granite wall, but still is Shipyard property.
3. This land is not owned by the Federal Government, but was included in the Congressional authorization for possible acquisition and use for Park entrance purposes.
4. Temporary taking for construction.
5. Does not include temporary taking.

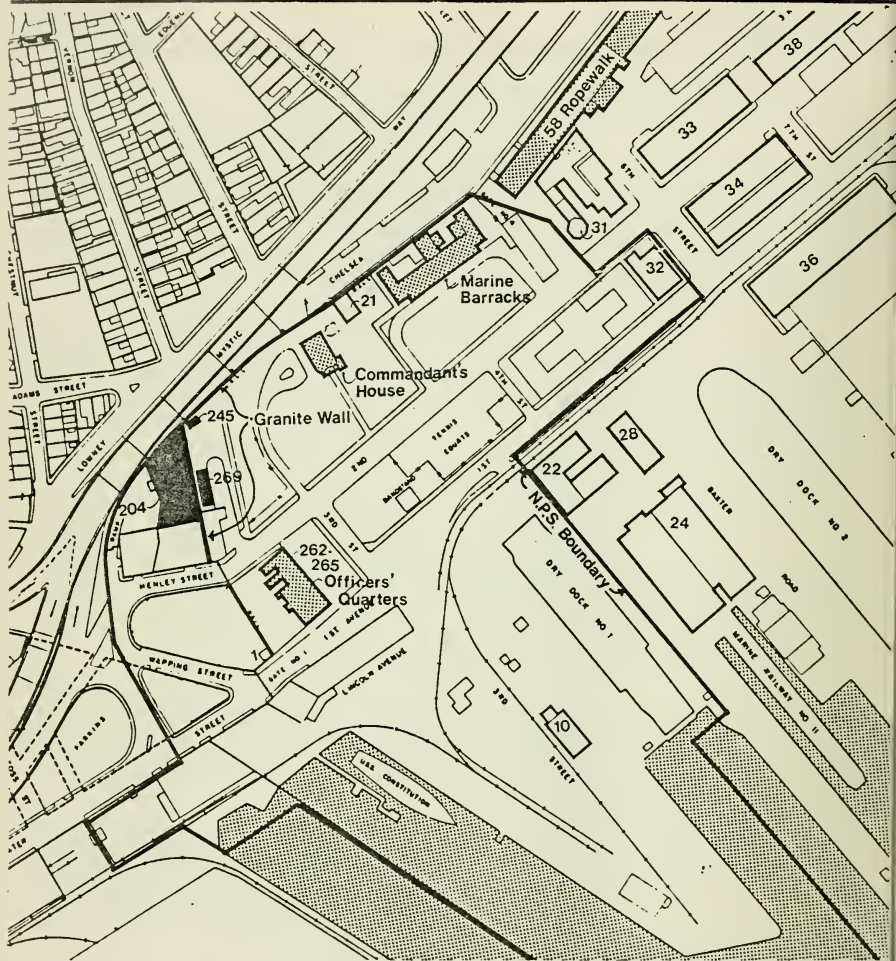


Figure 7a

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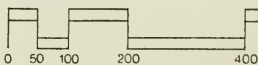
Historically valued buildings within the Shipyard

Historically valued buildings principally affected by the proposed improvement

Buildings demolished for the proposed improvement

Affected Shipyard Structures

Chelsea-Water Streets Connector · Little Mystic Channel Crossing
Draft Negative Declaration



Alternatives 2, 2A and 4 require the rebuilding of the wall not on its original location, but preferably along the roadway to separate the street from the National Park. Alternative 3 will permit the rebuilding of the wall on its original site, but may require underpinning or foundation bracing of the Commandant's house during tunnel construction.

The existing landscaping in this area will also be removed in all the Build alternatives. In Alternative 2, 2A and 4 new landscaping or relocation of existing specimens can be done inside the rebuilt wall to provide the visual screen effect which exists there now. In Alternative 3 the landscaping can be replaced on the original site, on top of the tunnel.

In Alternative 2, approximately 400 linear feet of the wall will be moved up to within 5 feet of the house, reducing the depth and sense of enclosure in the yard. The screen of trees will take time to mature, and in the interim the off-ramp and connector will be visible, as will the Tobin Bridge approach, over the granite wall. It will appear that the expressway has been brought closer to the Yard. In the long term the screen will be quite effective and the major difference from the existing condition will be the shape and size of the landscaped area and the distance of the wall from the house.

Alternative 2A's visual effects will be very similar to 2 except that the additional off-ramp will make the structure of the road larger and therefore more visible.

Alternative 4 will also be similar in appearance, except that the lack of structure on the off-ramp will make the road lower and therefore less visible.

Alternative 3 will appear quite different from the other because the wall and yard area will look approximately the way they do now. The ramp over the portal of the tunnel will be visible through the trees and will have the same general appearance as the existing bridge approach.

The view of the Gate 1 and 2 area outside the yard will change substantially. In place of the paved streets and vacant lots which are now between Water Street, Gate 1, Gate 2 and the off-ramp, there will be a landscaped street. In Alternative 2 there will be more space for ground cover and trees than in 2A and 3. Alternative 4 will be lower down, but will have the addition of a southbound movement. Alternative 3 will have a substantial visual impact from the portal of the tunnel and the ramp passing over it.

All Build alternatives have one positive aesthetic impact in common. The removal of building 204 will allow approaching pedestrians and motorists to see the Commandant's house, Marine Barracks, and granite wall at the same time as the masts of the U.S.S. Constitution.

Pedestrian Access. A new at-grade pedestrian crossing will be provided at Gate 4 to connect the new Park with the community. This crossing will make up for the increase in traffic on Chelsea Street, and for the additional barrier effects of the road. Further study should be made of the use of the existing pedestrian underpass across from the Bunker Hill Pavilion on Water Street. It will need to be either replaced, possibly with a walkway along Gray Street, or redesigned to lead the pedestrian from the tunnel to a new crossing of Water Street.

Alternative 3. The concept of a tunnel rather than an at-grade link is an attempt to avoid the permanent taking of Park land and its associated impacts.

Granite Wall. The wall will have to be dismantled, but it can be rebuilt on the original site once the tunnel is completed. As in Alternatives 2 and 2A, the mortar and vegetation will be new, but the relationship to the Commandant's house will not change.

Landscaping. Planting and the treatment of Gate 4 will be the same as that for 2 and 2A.

Pedestrian Access. Treatment of the crosswalks will be the same as in Alternatives 2 and 2A.

Special Treatment. The tunnel's open roof between the off-ramp and the granite wall would be fenced and perhaps covered with a grate to prevent accidents and vandalism.

Alternative 4. *Granite Wall.* The effects of moving and reconstructing the boundary wall of the Shipyard will be the same as for Alternatives 2 and 2A except that with an at-grade connector, the wall will be more visible.

Landscaping. Planting will be the same as for Alternatives 2 and 2A inside the Shipyard. Along Chelsea and Water Streets, this alternative provides more opportunity for at-grade greenery.

Pedestrian Access. Treatment of crosswalks will be similar to that for Alternative 2A.

Construction Period. Standard precautions will be taken during construction to minimize noise, dust, erosion and disruption of traffic patterns. These measures include:

- Staging and timing of construction will be planned to minimize traffic disruption.
- Use of dikes to control bank erosion at the bridge abutments and adjoining areas.
- Land disposal site for spoil materials from dredging Little Mystic Channel or arrangements for disposal in

will enhance the historic quality of the Shipyard.

INCREASE OR DECREASE IN PHYSICAL EFFECTS

The Build alternatives will divert traffic to the new Chelsea-Water connector. However, noise impacts will not be significant and air quality will be improved over the No-Build.

MEASURES TO AVOID AND REDUCE IMPACTS

The measures described here will help to minimize impacts from the alternatives by removing the cause of the impact or by lessening the effect. In addition, other urban design measures may be underwritten by the BRA or National Park Service as part of their plans for improvements in the Shipyard (see Ch. 5.N).

Alternative 1. Given the traffic volumes predicted for 1985 and 1995, traffic management techniques cannot be very successful in reducing impacts on residential areas or in providing good access for industrial and redevelopment uses.

Alternatives 2 and 2A. Granite Wall. In these two alternatives it will be necessary for the roadway to use the land now occupied by an 1825-26 granite wall, once the boundary to the Shipyard. This wall will be moved, by cataloguing the stones, storing them, then rebuilding it as a buffer between the Commandant's house and the road. The wall will not be able to be restored to its original condition: mortar will be replaced and the earth and vegetation around it will not have the settled look acquired over decades of weathering. However, the massiveness of the wall, and its ability to close off the yard will not be lost.

Landscaping will be necessary to replace as many of the large trees as possible in order to recreate the tree screen which now partially obscures the expressway. It will take time for these trees to mature, but when they are grown, the view of the area from the main park area, to the east will not be noticeably different from today for the casual observer.

Landscaping will also be provided along Water Street on the banks of the ramp and roadway outside Gates 1 and 2. These plantings will soften the visual impact of the roadway and will be in harmony with the plans of the National Park Service and the BRA. In the same way, plantings should be provided in consultation with NPS and BRA at Gate 4 and along Chelsea Street. Some additional space for entry use will be provided at Gate 4 to improve sight lines and to allow for landscaping. Chelsea Street will be repaired and given new curbs and sidewalks.

the "Foul Area" at longitude 70° 34.5'W and latitude 42° 25.5'N.

- Mats, dampening and other measures will be used to control dust generation at construction sites.
- All equipment and procedures will conform to the City of Boston's ordinance regulating noise, air pollution and other aspects of construction operations.
- After completion, all excess land can be passed to the National Park Service as a measure to reduce impacts through landscaping or other measures to enhance the park experience.

During the construction of these alternatives the whole area will be quite torn up and disrupted. The traffic will not be interrupted, but there will be noise, dust, and the visual evidences of excavation and construction. Alternative 3 will take up to six months longer than the others to build.

In addition, monitoring will be undertaken to ensure that excavation, air or ground borne vibrations do not endanger the foundations and other elements of building 1 and of the Commandant's house. If any remedial measures, such as underpinning, prove necessary, they will be immediately undertaken.

COORDINATION WITH NATIONAL PARK SERVICE

There has been substantial coordination with the National Park Service throughout all phases of design and evaluation of the proposed alternative. The joint planning efforts of the Boston Redevelopment Authority and NPS have provided a forum for presentation and discussion. In addition, the park's Superintendent has attended both public and agency meetings where the alternatives and their consequences for the park have been discussed in relation to park plans.

7.C. Determination of Feasible and Prudent Alternatives

Careful review and consideration of all the factors involved suggests that there is no feasible and prudent alternative to taking approximately 1 acre from the Shipyard in order to secure the varied environmental, economic, and transportation benefits of the proposed improvements.

The No-Build alternative preserves the physical resources of the Shipyard, but makes their access and enjoyment so difficult and unrewarding as to compromise the value of the National Historical Park. It also results in further deterioration of ambient environmental conditions in residential areas and constrains potential economic growth

through worsening traffic congestion and its attendant impacts. The No-Build is a feasible alternative; however, its indirect impacts are of such a magnitude as to make its implementation imprudent.

The Build alternatives significantly improve visitor access to the National Historical Park; do not require northern Shipyard traffic to travel through the Park; and secure the varied environmental, economic, and transportation benefits which motivated the proposed improvements. These benefits are gained at the cost of impacting some land and structures of historic significance in the Shipyard.

Construction of any of the Build alternatives will provide the desired transportation service and make funds available to design and implement all possible planning and measures to minimize harm to affected historic resources. All Build alternatives provide adequate compensation for takings as follows:

- Alternatives 2 and 2A are technically, environmentally, and financially feasible because their costs and those of their associated measures to minimize harm are in keeping with the extent and significance of impacts. However, they conflict with proposed plans to reconstruct the Tobin Bridge approach ramps. Hence, Alts. 2 and 2A are feasible, but not prudent.
- Alternative 3 is technically and environmentally feasible. Restoration of existing Shipyard conditions is most nearly complete with this alternative. However, Alternative 3 is financially unfeasible. Its cost and those of associated measures to minimize harm seem disproportionate to the magnitude of the impacts involved. These costs exceed appropriations for this kind of project. The City of Boston's share of state and federal Urban Systems funds is less than \$5 million/year. It is very unlikely that Alt. 3 would be funded because it would preclude other improvements in the City for over 2 years. In addition, Alternative 3 precludes proposed reconstruction of the Central Artery and Tobin Bridge approach ramps. Hence Alt. 3 is neither feasible nor prudent.
- Alternative 4, the preferred alternative, is both feasible and prudent. Its costs are in keeping with the magnitude of impacts; its associated measures to minimize harm restore the character of the Shipyard; and it is compatible with proposed reconstruction of the Tobin Bridge approach ramps.

Letter from National Park Service's Regional Director

L-58-NAR-(CF)

March 3, 1975

Mr. Gerald W. Bush, Director
Commerce and Manpower
Room 808A
City Hall
Boston, MA 02201

Dear Mr. Bush:

The following information is in response to your request for a statement as to the position of the National Park Service in reference to the question of access to the Boston Naval Shipyard.

Once the National Park Service has acquired its portion of the Navy Yard we intend to close gates 1 and 2, which now provide for through vehicular traffic to the remaining portion of the shipyard beyond the authorized park area. This would be accomplished as soon as alternate access can be provided. Termination of rail access through the park is also proposed. A heavy flow of industrial and commercial vehicular traffic through the park would be incompatible with the historic setting and proposed visitor use patterns, and therefore, must be eliminated if National Park Service policies and standards are to be maintained.

The closing of gates 1 and 2 to through traffic will necessitate some alternate access routes to the remaining portion of the Navy Yard to insure that a full and economically viable reuse of the yard can take place and that the needs of the community of Charlestown are met. All funding required to implement alternate access routes is to be provided by an agency other than the National Park Service. We are fully aware that the question of access through the park is not isolated to gates 1 and 2, but is tied into a multiplicity of city and state transportation and urban renewal problems which have created traffic congestion for many years prior to the specific issue raised by the park proposal.

The National Park Service is sensitive to the need for adequate access to the remaining portion of the shipyard, and cognizant of the desire of the community of Charlestown to eliminate truck traffic from their street. We have been meeting for some time with city, state, and community groups to explore the potential solutions to this problem.

The National Park Service position was arrived at after detailed discussion with the city and state, which suggested the implementation of a three-part program designed to resolve the access problem so that work can continue both in terms of designing the park and in planning and marketing the proposed industrial area.

The first step in the program is the development and acceptance of an interim access plan for the industrial park. This plan calls for controlled access through gate 2 and along Second Avenue and controlled rail access during the period while the park is under development. This phase will last 3 years from the first congressional appropriation of development funds for the Boston National Historical Park.

Step two is a development program to be completed by the city and state within the above stated 3-year period to allow the closure of gates 1 and 2 to through traffic. It consists of a two-way connection between Chelsea and Water Streets and will require the movement of a section of a historic wall and the possible creation of adverse effects on the historic Commandant's quarters.

In addition to our concerns over the loss of park lands created by the second step and the potential adverse effect on the historic wall, the Commandant's House, and the open space surrounding it, the Chelsea-Water Street connector and a new Little Mystic Bridge also causes us some concern as to the possible adverse intermixing of heavy commercial trucking traffic and visitor traffic as they would flow through City Square and along Water Street. It is our understanding that the community of Charlestown shares our concern as to the effect of additional commercial traffic through the City Square area.

It should be emphasized that all costs for this project including those efforts needed to minimize any potential harm to the historic environment will be the responsibility of the initiating agencies.

The third step of the proposal is for the city and state to develop optimum solutions to this complex problem. If an early solution could be produced which is acceptable to all parties, the second step would be dropped and the new solution pursued with all possible speed. In the event the optimum solution requires a long development period, it may be necessary to proceed with the second step as a temporary measure. This could be the case if major changes involving the Mystic River Bridge are required.

It should be clearly understood that any agreement on the above terms, on the part of the National Park Service, will be subject to review and that all the legal requirements under the 1966 Historic Preservation Act as well as the National Environmental Policy Act must be met.

It is our understanding that an Environmental Impact Statement is about to be initiated on the Chelsea-Water Street connector and a new bridge across the Little Mystic Inlet. Because of the potential effect of the project upon the National Park, we would expect to see full compliance with the National Environmental Policy Act (Public Law 91-190) including the full development of (4F) information on the Park. In addition, since the entire shipyard is a National Historic Landmark on the National Register of Historic Places, the Environmental Impact Statement must comply with the requirements of the 1966 Historic Preservation Act and Executive Order 11593, including a full 106 review. All prudent and feasible alternatives need to be developed along with mitigating measures and if unavoidable adverse effects are created, then all efforts to minimize harm must be specifically defined.

If you feel a meeting would be productive, we will make ourselves available at your request. We will be glad to further participate in the planning process to assist you or your consultant.

Sincerely yours,

Jerry D. Wagers

Jerry D. Wagers
Regional Director

cc: Mr. Robert T. Kenney
| Mr. Paul May

Chapter 8

Section 106 Review

A. Proposed Improvements

The proposed transportation improvements evaluated in this Section 106 Case Report are to be located in Charlestown, a district of Boston, Massachusetts. The improvements have two elements: the connecting of Chelsea and Water Streets and a bridge to carry Chelsea Street across the Little Mystic Channel. These new facilities are directly related to existing transportation problems in the area and other proposed changes and new developments in Charlestown.

B. Description of Charlestown

Charlestown is located on a peninsula to the north of Boston proper, bounded by the Charles River, the Mystic River and the inner Harbor -- the original hilly peninsula that contained the early settlement and the later town expanded by filling around the edges to accommodate industrial development. Geographically isolated from the rest of Boston, the town is traversed by I-93 and the Tobin Bridge. These elevated highways, and the elevated MBTA structure (now dismantled) have had a blighting effect on the town.

Charlestown is a residential, family-oriented neighborhood with a present population of 16,000. This population has been steadily declining over the last thirty years, though this trend now appears to be reversing. The community's population structure has remained stable, consisting mainly of descendants of Irish settlers from five or six generations ago, Canadians, and recently an influx of young families and single people of varied ethnic background.

The southeast part of Charlestown is a residential community with an historic tradition built into a distinctive cityscape over several centuries. Today it has many features and buildings of national as well as local historic significance. Tourists visit Charlestown not only to see the U.S.S. Constitution and the Bunker Hill Monument but also to experience the unique 18th and 19th century residential character that still exists only in some of the older eastern seaboard cities. Along narrow streets lying across two gently sloping hills are continuous rows of old, well-built, two- and three-story houses with harmonious facades designed in many architectural styles which give great attention to details. Occasional alleyways provide glimpses of backyard flower gardens. Charlestown is a pleasant place to live and its qualities are very dear to its residents; but the relationship to the historic harbor, Shipyard, waterfront recreation activities, and the city beyond is interrupted by the visual and physical obstruction of expressways, the Tobin Bridge, and the dominance of the waterfront industries.

There is great interest by the community of Charlestown in preserving its history, including the important buildings of the Boston Naval Shipyard. This interest has been supported by the city and state, resulting first in the inclusion of the yard on the National Register of Historic Places in 1966, and second, in the designation of 27 acres of the original yard as one site of the multi-site Boston National Historical Park in 1974. A summary of the Park Service's and BRA's plans for the yard follows the description of the history of the Shipyard.

8.C. Description of Alternatives

ALTERNATIVE 4 IS THE CHOSEN ALTERNATIVE

The proposed improvement consists of a roadway to connect Chelsea and Water Streets and a bridge to link Chelsea Street and Terminal Street across the Little Mystic Channel in the Charlestown district of Boston. These connections will provide routes for traffic which will remove trucks and many autos from local streets, provide better access to industrial areas, and enable the National Park Service to close the former Boston Naval Shipyard to through traffic in accordance with their plans for a national park site.

ALTERNATIVE 4 - PREFERRED ALTERNATIVE

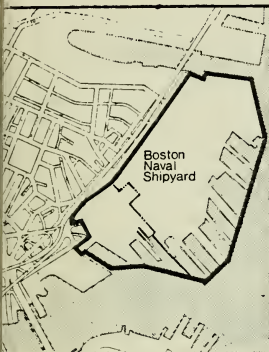
Undivided At-Grade Link, North and Southbound Off-Ramp. The north and southbound lanes of the roadway would not be separated. The off-ramp would intersect with the link at-grade both north and south turns would be permitted.

8.D. Description of Boston Naval Shipyard at Charlestown

8.D.1. Existing Conditions

The Boston Naval Shipyard in Charlestown is currently owned by the U.S. Government under the jurisdiction of the General Services Administration. The Shipyard consists of 85.24 acres of land and 46.07 acres of wharf structures over water for a total of 131.31 acres. The Shipyard is located along the eastern edge of Charlestown and is bordered by Chelsea Street to the west; the Charles River to the south; the Mystic River to the east; and the Little Mystic Channel to the northeast (see map).

(The following are excerpts from "A National Historic Park and Naval Museum Charlestown Navy Yard", Boston, Massachusetts, prepared by the City of Boston, Kevin H. White, Mayor, Boston Redevelopment Authority, Robert T. Kenney, Director, 1973.)



Structures at the Charlestown Navy Yard contain a massive amount of industrial space differing considerably in age, efficiency, and suitability to current industrial practices. A total of 86 buildings providing approximately 3.5 million sq.ft. of floor space are located on the site. Approximately 90% of the space is contained within 37 buildings having 10,000 or more sq.ft. of floor space. Most of these structures are industrial facilities built during periods of wartime activity and include brick or granite bearing walls, two- and three-story structures, and eight-to-ten-story brick and concrete warehouse buildings.

Other structures at the Shipyard include two dry docks, a marine railway, and two ship building ways. Of the eleven piers at Charlestown, two are substantially filled land. Five are wooden piers on wooden pilings and show varying degrees of deterioration.

8.D.2. Development of the Shipyard

The Charlestown Navy Yard has major historical significance due to its connection with the Revolutionary War and the establishment of the U.S. Navy, its role in the building and maintenance of important ships of the fleet, and for the firsts in naval facilities and operations which occurred here.

The Shipyard developed on the southeasterly shore of Charlestown between what was known as "Wapping's" (near the site of the first Charlestown Bridge of 1786) and "Moulton's Point" where the British landed for the assault on the patriots in the famous 1775 Battle of Bunker Hill. On this marshy shore were several shipyards and private wharves. The best known of these was Edmund Hart's yard where the U.S.S. Constitution was built between 1794 and 1797.

At the close of the 18th century, the local shipbuilding industry was revitalized after a period of decline during the Revolutionary era. It was during this time, several months before the establishment of the U.S. Navy Department in the spring of 1797, that a resolve from the Naval Committee of the House of Representatives recommended that an appropriation be made for the establishment of a government dockyard. The existence of active shipyards made the Charlestown site a logical location for such a dockyard. Three years later, in the spring of 1800, Secretary of the Navy Benjamin Stoddard proposed the purchase of land at Boston for such a purpose. Later that year, 43 acres of land and mudflats were purchased at Charlestown for a sum of \$39,214.

The yards which were set up along the eastern seaboard during the opening years of the 19th century were not intended to be defense stations but were rather intended for shipbuilding and repair. Thus, even though an 1818 survey of Boston Harbor found it to be an "extraordinary natural means of defense" the Navy Commissioner did not recommend the establishment of a "great national depot and rendezvous at Boston" but a dry dock to facilitate ship repair work.

During the 1820's, the Shipyard substantially increased its buildings and facilities. In 1827, Congress declared that examination of the yard must be completed before any further improvements were made. That examination was begun in 1827, and the resultant plan was issued in the summer of 1828. This plan continued to be in effect until 1880 when a new plan was created.

SHIPS ASSOCIATED WITH THE SHIPYARD

Although the U.S.S. Constitution predates the Shipyard, the ship was moored here almost continually after its famous victory over the Guerriere in the Mediterranean in 1812. Originally launched in 1797 in Boston, the U.S.S. Constitution first saw battle duty during the undeclared war with the Barbary States in North Africa in 1803-4. It was here that she first earned the sobriquet "Old Ironsides" as a result of the strength of her wooden armor, reputed to have repelled the enemy's cannon fire. During the War of 1812, she engaged in a number of successful battle operations, the foremost of these being her defeat of the British frigates Guerriere and Java. In the course of the war she became the nation's most successful war ship of the era. Saved twice from destruction during her history (the first time was a result of Oliver Wendell Holmes' poem "Old Ironsides"), she is today the Navy's oldest commissioned ship.

Among the ships constructed at Charlestown were the Boston (1799), financed by Boston Merchants, and the Independence (1814), a 74-gun considered to be "the finest and heaviest frigate-built vessel of her time". One of the most famous ships constructed at the yard was the Merrimac (1854-5), which was converted into an ironclad after its seizure by Confederate forces during the Civil War and was renamed the Virginia. It was sunk after the well-known encounter with the Union ironclad Monitor at Hampton Roads.

During war time, the shipbuilding and repairing capacity of the dockyard increased enormously. Between 1861 and 1865, 39 ships were constructed, 43 ships were equipped, and

countless numbers repaired at the yard. In 1874, the In-trepid, the first iron torpedo boat, was launched. During World War I, the yard was primarily used as the chief center for the North Atlantic. World War II witnessed the peak of the yard's productivity: 165 ships over 100 feet long were built, and hundreds of smaller craft and thousands of boats were repaired. Post-war activity at Charlestown and the South Boston Naval Annex has involved submarine construction and many conversions of ships for guided missile and anti-submarine duty.

TECHNOLOGICAL INNOVATIONS OCCURRING AT CHARLESTOWN

The Charlestown Shipyard has been the site of several unique facilities since its inception. Commandant Bainbridge, in 1813, suggested that "shiphouses" be constructed to build ships undercover, thereby protecting them from the elements and speeding production. The idea proved so successful that it was copied in other shipyards in this country and abroad. In 1815, Bainbridge established a naval officers training school at the yard that was a predecessor of Annapolis.

In the next decade, Dry Dock 1 was begun (1827) and is one of the two oldest drydocks in the country (both were completed in 1833). Ironically, the U.S.S. Constitution was its first occupant and shall be the last commissioned ship to be overhauled there. In 1836, the 1,350-foot-long rope walk was constructed. This granite structure provided all of the rope requirement of the Navy for the last 135 years with production ceasing only in the past decade.

SCENIC WATERFRONT

From its vantage point at the head of Boston Harbor, there are interesting vistas in at least three directions. Those views to the East Boston Waterfront and Massachusetts Port Authority piers are somewhat less favorable than the excellent views down the shipping lanes and across the Inner Harbor to the varied Boston skyline. Unlike Boston's downtown waterfront, there are no major structures on the finger piers which extend into the Inner Harbor making both the views and the water easily accessible. Although the water quality is fairly poor (level C), it is adequate for recreational boating.

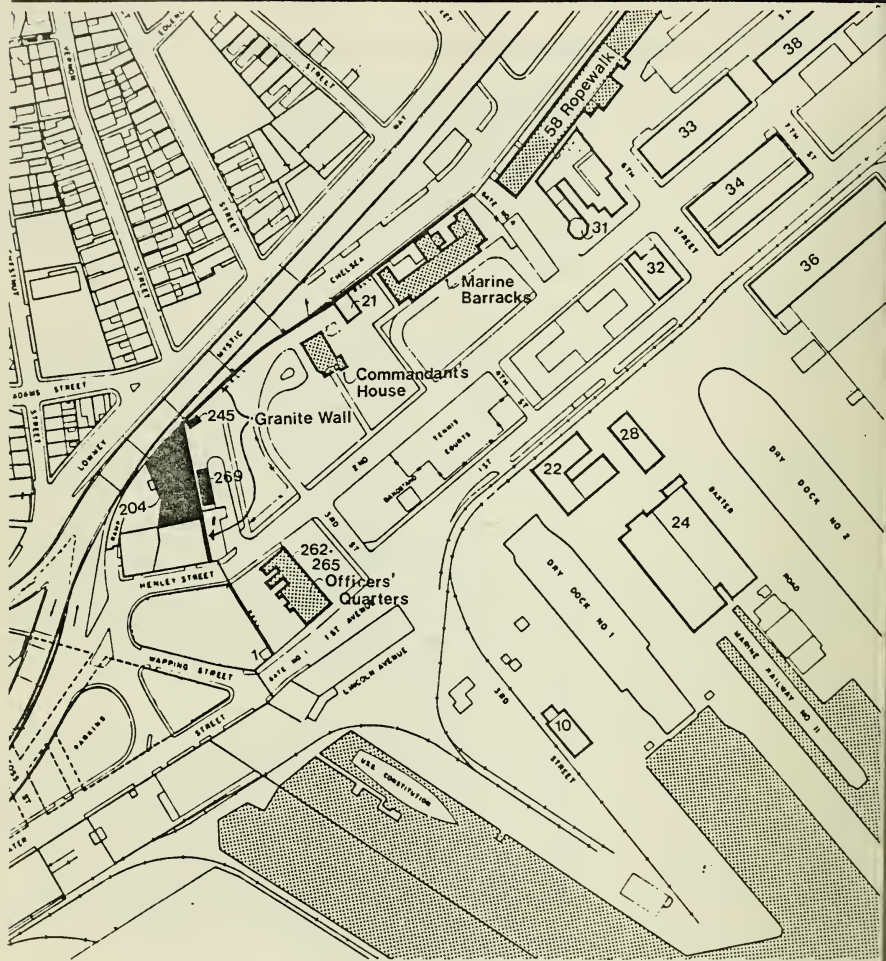


Figure 8a

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Historically valued buildings within the Shipyard



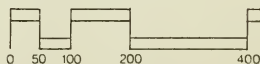
Historically valued buildings principally affected by the proposed improvement



Buildings demolished for the proposed improvement

Affected Shipyard Structures

Chelsea Water Streets Connector • Little Mystic Channel Crossing
Draft Negative Declaration



8.D.3. Description of Historically and Architecturally Important Features

The following buildings and features have been described as important by the Boston Redevelopment Authority (A National Historic Park and Naval Museum, Charlestown Navy Yard, 1973) and the National Park Service (An Alternative for Development, Boston Naval Shipyard, 1974). The historically valued elements most affected by the proposed road improvements which are in the Park area or outside the Park but designated for facade restrictions have been described in greater detail here. A bibliography of sources for detail is included in this report. The following account was taken from the two sources cited above except for the account of the granite wall, which is based on research from the Navy's DPW files. (See fig. 8a.)

A triangle (▲) symbol indicates that the structure is to be moved. A star (★) symbol indicates that the structure is to be taken for the proposed improvement.

Quarters G: Commandant's House. Listed on the DPW property record cards as built in 1809, but there is also evidence to indicate that the house was completed as early as 1805. More speculation has been written about who designed this building than any other in the yard. It has been attributed to Charles Bulfinch which may be unlikely because of the heavy-handed style found throughout. The architectural style falls into the late Federal Period. (See fig. 8b.)

The house is a two-and-a-half-story brick building set on a high granite base. It was built on the highest piece of ground in the yard next to the Old Salem Turnpike with a view of Breeds' Hill and Charlestown across the way. Access to a flat on the roof provided one with a clear view of the Shipyard and the Boston waterfront beyond. The house has been used as a Commandant's house since its construction.

The earliest known view of the Commandant's House is from a painting dated about 1823. Another sketch made around 1836 shows the changes made to the exterior of the house up to that time, if the depiction is accurate. The earliest set of drawings kept in the files of DPW are dated 1849. From this date on the many changes to the house can be documented quite accurately.

The house is surrounded by a landscaped area which gives it a residential character in contrast with the rest of the Shipyard. South of the building is a former orchard, which has ornamental shade trees as well as fruit trees.

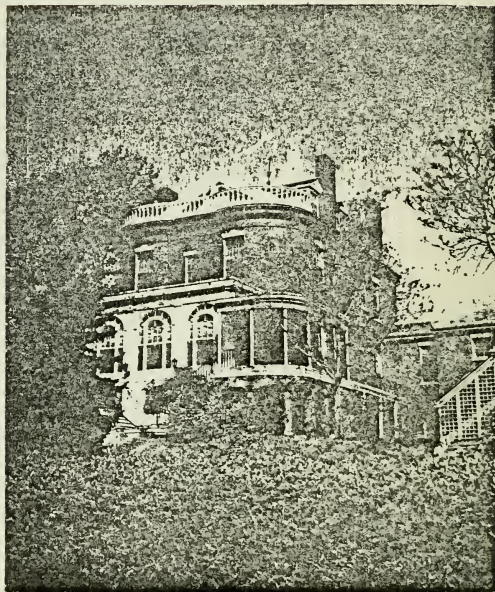


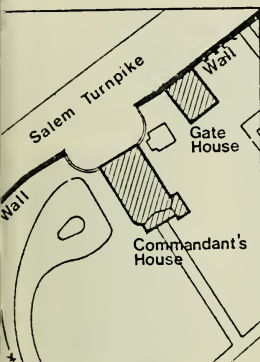
Figure 8b.

Quarters G: Commandant's House. View from the southeast, along Second Avenue.



Granite Wall: A granite wall built in 1825 and 1826 marks the boundary of the yard from Gate 1, where it is twelve feet high, to Gate 4 where it is only several feet high. Instructions for building the wall directed that it be "substantial, doublefaced, fair split faces, and smooth points; capping, coursed stone bedded in mortar; and the wall to be sufficiently high to protect the yard against fire." (Preble)

The Commandant's House faces the wall at a distance of 20 feet and the front entrance (toward Chelsea Street) is no



longer used. When the wall was built it was determined that the "circular wall from the Turnpike (now Chelsea Street) to the Commandant's House, (should) be (the) same height and thickness as the wall along the Turnpike, and corresponding in courses and fair surface." (Preble)

Shipyards plans show this semi-circular indentation in the wall as open to the street until 1864. (See drawing.) Then there is shown variously a broken line across the entrance indicating a gate, a light solid line and a heavy solid line. Post-1900 drawings do not show the circular portion of the wall, although the low walls exist today. (Apparently they were never raised according to the above specifications.) The variations in the treatment of the entry through the wall to the house can probably be explained by the quality and level of detail shown in the various plans. It seems likely that at some time in the late 1800's the wall was entirely closed in a straight line across the entrance to the house. This suggestion is supported by a change in the courses and size of stone at the appropriate places in the wall (see fig. 8c).

A number of other openings in the wall are recorded at the Marine Barracks, the Marine Officers' Quarters, and the hospital near Gate 5. There is no record of an opening at Gate 2 (Henley Street) until 1940, although there have been buildings on the site of the current gate house.

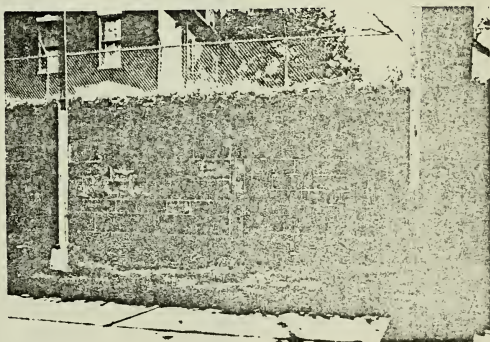


Figure 8c.
Exterior view of Granite Wall seen from Chelsea Street

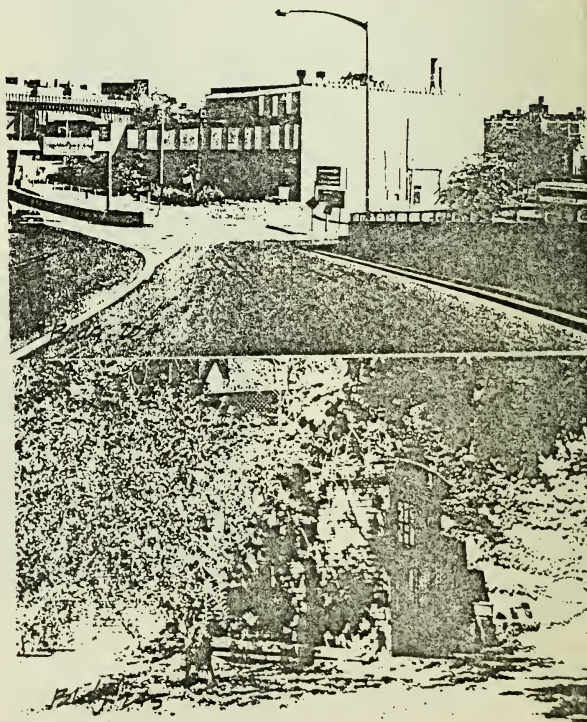
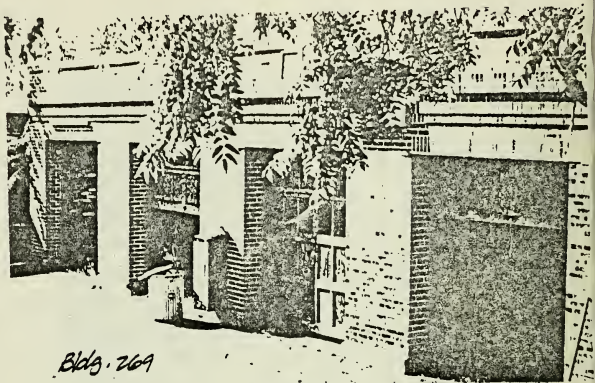


Figure 8d.
Shipyard structures taken for the
proposed action Build Alternatives.

Building No. 1: Gate House No. 2, Garages and Quarters. As early as 1857 a tank shed appears on the site presently occupied by Building No. 1. After their removal in 1905, it appears from the yard plans that a small shed for mason's supplies was erected and used until 1915 when it became a garage. In 1936 the WPA project remodeled the site by building a three-car garage and quarters for the Commandant's chauffeur. It is possible that a portion of the mason's shed now occupied as a sentry station was incorporated into the existing building. In 1959, a sentry shelter roof was added over the sidewalk.

This building abuts a granite wall built in c. 1822 which formed the west boundary of the yard. It is a one-story brick structure of functional design with relief patterns of row-lock brick courses built into the wall just below the parapet of the roof and above each of the door and window openings. The interior rooms appeared to be plastered and painted surfaces.

★ Building No. 269: Garages for Automobiles. This one-story, flat-roof, brick building containing five automobile storage spaces was built in 1941. It is constructed a few feet north of Building No. 1 and required the excavation of about five feet of earth to provide the level site. A concrete retaining wall surrounding the driveway was built at this time. There is one garage for each of the five officers' quarters in Building 265. (See fig. 8d.)

★ Building No. 204: Chelsea Street Garage. The current use of this building is a Public Works garage for automotive vehicle maintenance and offices, drafting rooms, and the P.A. system for the Navy Yard. Built in 1942, it has undergone slight additions and alterations in 1948, 1951, 1963, and 1969, according to the card file kept by the DPW. This building abuts the granite wall of c. 1827 to the east. It is a partly two- and three-story frame building with a flat asphalt and gravelled roof. The building is located outside the original yard grounds. (See fig. 8d.)

★ Building No. 245: Gardener's Shed. Located in the northwest corner of the Navy Yard opposite the Commandant's House. According to the DPW records this building was constructed in 1929. It is a frame structure with a flat, arched roof covered with metal. The exterior is finished with painted clapboards while the interior walls and ceiling are lined with beaded boards. Because of the double doors located in the east end, this building appears to have been built first as a garage and then later moved to this location. It rests on a concrete slab. Its present use is for storage of gardening equipment. Condition: good. Approximate size: 14' x 20'. (See fig. 8d.)

Building No. 21: Inactive Carriage House for the Commandant. The records of the DPW indicate that this building was constructed in 1840 probably as a carriage house. It appears on the Yard Plan of 1857, our first complete plan

after the one of 1828. It remains unidentified on each successive Yard Plan until 1880 when it is called the "Greenhouse". In 1908 it is called the "Commandant's Watch House", and in 1911, the "Commandant's Barn". From 1913 until 1964 the name reverts to the "Greenhouse". In 1964 it is identified as an inactive carriage house. The term "greenhouse" probably originated in 1880 when a glassed-in addition was built across the south gable end and a small door opening was cut through the granite wall for access. This greenhouse addition was used, after two subsequent remodelings, until after the 1950's when it was removed.

Building No. 21 is a one-story granite structure with a slate roof, gabled on the south end and hipped on the north end. It has absolutely no architectural refinements. The granite blocks used in the wall construction appear to be left over or ones rejected from the granite buildings of the yard. There is no definition of the window sills or lintels nor is the arched door opening to the west built with stone voussoirs but simply stones corbeled over the archway. The walls and corners of the buildings have no workmanship or quality. It is a strange building indeed.

Building I: U.S. Marine Corps Barracks. This building has been used in part as a barracks building since its initial construction. The date of erection assigned to this building by the DPW is 1823. This coincides with the outline of the building found on the Navy Yard Plan of 1823. Two views of the Marine Barracks drawn in c. 1823 and c. 1825 both verify the accuracy of the building outline as shown on the 1823 plan. The original plan of the building seems to have been a long one-story gabled building attached to a single three-story structure at each end giving the plan a U-shaped arrangement. This U-shaped plan survived until 1868 when an ell addition was built to the north off the central one-story building. This addition appears on the Yard Plan of 1868, while drawings dated 1861 kept in the files of DPW indicate the scope of the proposed work to be done.

Like the Commandant's House to the west, the site selected for the barracks stood on the highest point of land in the Navy Yard. A small parade ground has always existed between the barracks and 2nd Avenue which in 1823 was simply the southern boundary of the Marine Corps property. The layout of 2nd Avenue came in 1828 according to the Yard Plan of that year. These early buildings appear to be of brick construction. The three-story building flanking the west side seems to have always been used as the commanding officer's house while the east three-story structure was used for officers' quarters.

According to the DPW card file, the entire structure was raised to its present height of four stories in 1870. A one-story piazza or porch may have been added across the front of the building or at least renewed. In 1871, 1936

and 1962, the Yard Plans show that the rear of the buildings underwent a series of infillings between the ell and the end wings. Four-story porches and stair towers were added across the south wall, excluding the side wings, in 1940. It must be pointed out that the two flanking buildings were always built with a slight projection south of the center portion. This would account for the reason that the porches stopped short of running full length of the south facade. Exterior fire escapes were added in 1944. In order to provide additional sleeping quarters for the enlisted men, the four-story porches were enclosed in 1951 according to the DFW card file.

Shipyard Plan: The 1828 plan for the Shipyard imposed, for the first time, a logical order for future development. An interior rectilinear grid was combined with the original street layout. Canals were laid out between the structures to facilitate the moving of heavy equipment and materials and to ease the problems of drainage during the landfill operation which extended the usable land at the Shipyard.

During the next 20 years, a considerable amount of construction took place, corresponding with the most active period of shipbuilding. Most structures were built of granite, in keeping with the popular use of granite for prominent civil buildings in Boston such as the Custom House, harbor wharf, warehouse buildings, and religious structures. Structures dating from this period include:

Dry Dock No. 1, 1827-33: This dry dock, built of granite blocks with a "foundation on piles on which is laid an oaken floor", was authorized by President Andrew Jackson in 1827.

The engineer for the project was Loammi Baldwin, Jr., who was responsible, with his father, for the engineering of the Middlesex Canal. Dry Dock 1 was completed in 1833 at a cost of \$677,089. The first ship to enter the dry dock was the U.S.S. Constitution.

Officers' Housing (262/5) 1833: This brick residential row of five houses in the Greek Revival Style is an outstanding example of such rows that proliferated in Charlestown, Beacon Hill, and Bay Village. Set parallel to the approach axis to the Commandant's House, the row faces the broad lawns and parade ground that spread before the knoll of the mansion.

Wood-Metal Shop (22) 1832: The first of the major multi-story granite buildings, this structure may have been designed by Alexander Parris, noted architect of the Faneuil Hall Markets, 1824-26. Adjacent to Dry Dock 1, it was built to house the steam engine used to pump out the dry dock. The three-story, L-shaped structure is relatively free of ornamentation but is pleasing in scale and in the rhythm of 12 over 12 pane sashes. The facade is accentuated by a central shallow pavilion with a pedimented gable.

Building 58 Ropewalk 1834-37: The original building was on continuous structure 45' x 1,360' long for laying up ropes and known as "the walks". Two hundred feet of this structure was two stories. A head-house, 70' x 60', three-and-one-half-stories high with basement, housed two steam engines of 30 and 15 horse power and boilers. Part of the building was fireproof, having a brick-arched ceiling supported on cast-iron beams. The walls are faced with granite backed with brick and are two feet thick. Doors and windows were originally covered with iron shutters, now removed. The roof material is Welsh slate. The study by the Harvard graduate students Helen Davis, Edward Hatch and David Wright mentioned that the preparing and spinning room were centrally heated by exhaust steam from the engines passing through seven-inch-diameter cast-iron pipes, but no evidence of this was found by the investigating team. Additions were made to the second floor c. 1865 and 1908-1910 extending it 784 feet and another 100 feet, respectively. All original ropemaking machinery was invented and built by Daniel Treadwell; some survived and may be original. It is of concern that some of the equipment, such as the spinning machine sits unprotected and liable to pilferage. Other bits of machinery may have already been scrapped.

Laboratory Building (62) 1842: Originally built as a storage house for hemp used in the ropemaking process, this building along with the tarring house (60) was designed by Alexander Parris.

Shop & Docking Office (24) 1847: Stylistically, this large two-story granite structure links the buildings of the 1830's to the shed structures of the 1850's. Used as carpenters' shop and rigging loft, the building originally had a cupola and bell used to summon the men to work. Located between Dry Docks 1 and 2, Building 24 is one of the few early structures placed perpendicular to the principal axis of the Shipyard.

1850-1870: The Civil War period saw the construction of the last of the large granite buildings. Building shape and mass did not differ essentially from the earlier granite types, but the treatment of the granite was more robust. Several brick structures were added during this period as well. The larger brick structures exhibited more romantic shapes and silhouettes. The inspiration for such buildings were the popular interpretations of European styles of the Victorian era, such as the Italianate, French Mansard, Medievalizing, Romanesque, and Gothic Revival Styles. Buildings from this Civil War period include:

Building 33 1850, 36 1850's, and 38 1854: These functional structures flank and parallel the earlier Building 34. Generally used for storage, they also housed a sail loft and joiners' shops in the 19th century. Their placement reflects the rectilinear grid of the 1828 plan which was later extended toward the Mystic River end of the yard. Like 34, these buildings are long granite structures with

loadbearing walls and ridge roofs. For textural contrast and sparse ornamentation, rough hewn dark granite is relieved by light-colored, smooth granite used on lintels, entrance frames, strongcourses, quoins, and cornices.

Building 66 Laboratory (28) 1850, Ship Repair Office (10) 1852, Storage Building (79) 1852: Generally, these are two-story brick oblong structures with hipped or pitched roofs that display the familiar shape of Greek Revival buildings. No. 79 has a granite first floor and brick superstructure; its placement along the axis of the ropewalk makes the two buildings appear as a single linear element.

Telephone Exchange (31) 1852: Among the most curious of all structures within the yard is this three-story hexagonal tower. Each wall has two window bays in each story, which are separated by string courses. An ornate modillion block wood cornice sets off the hipped roof on which a wooden cupola sits. It is the single 19th century structure with a vertical emphasis in the Shipyard.

Bank (32) 1857: In contrast to its neighbor, the telephone exchange, the bank is a one-story, oblong, hipped roof building. Built as an "ordinance shell house", the structure was originally windowless; the walls treated as a blind arcade with full round headed arches. Windows were added later in the 19th century when the building was used as the Commandant's office. Some of these have since been bricked up.

1870-1906: The next major construction period centered around the Spanish-American War. Generally, the remaining structures are large brick structures which exhibit popular commercial styles of the day. Buildings from this period were generally located northeast of the granite structures in the same grid pattern, although those south of First Avenue are oriented to the finger piers and are perpendicular to the avenue. In 1899 the second dry dock was constructed and first occupied by U.S.S. Maryland in 1905. Buildings from this period include:

Roundhouse (105) 1903 and The Paint Shop (125) 1906: Each of the main elevations are symmetrically organized by areas of arched windows with elaborate brickwork in classically-inspired designs.

1906-Present: Twentieth century buildings are generally the largest and tallest of all buildings in the yard, indicating, logically, the need for enormous spaces for construction and repair of increasingly larger vessels. Modern techniques, of course, permitted construction of these spacious sheds. In addition to the shed buildings, much of the construction involved small connecting buildings, storehouses, substations, and service buildings. All serve functional industrial purposes and have little or no architectural significance.

8.E. National Park Service Plans

The section of the yard designated for development as a National Park site is due to be transferred to the National Park Service in January, 1976.

The following information on the Park Service's plans has been excerpted from the National Park Service's Boston Navy Shipyard: An Alternative for Development, March, 1975.

The primary purpose of the proposed national historic site is to provide for the interpretation of the historical development of the yard, of the U.S. Navy, and of the U.S.S. Constitution. Administrative and maintenance functions will be required for the Shipyard and the Constitution. The U.S.S. Constitution Museum Foundation, Inc. will provide a museum and sales facility, as well as services supporting the Constitution and the National Park Service. The grounds will serve as a setting for interpretation, and also provide passive recreation for the visitor.

The acquisition of development restrictions (facade easements) is proposed for several structures that lie outside the proposed national historic site boundary, to ensure their historical and architectural integrity, and also to ensure their retention as a permanent scenic backdrop to the proposed historic site: Buildings 31, 33, 34, 36, 38, 39, 58, 60, 62, 75, 79, 120, 123, 200, and 266. Buildings 104, 105, 106, 149 and 266 should be given special attention because of their architectural interest.

Four primary use-functions can be identified at the proposed national historic site: the entrance area, the visitor-use area, the support facilities area, and the administration area.

The organization of these uses in the most desirable arrangement relative to existing facilities is important to ensure a pleasant visitor experience, and to ensure functionality. The primary visitor experience at the Park will be the actual boarding of the U.S.S. Constitution. She will be restored to "fighting trim", as though ready to put to sea in defense of her country. U.S. Navy seamen dressed in period uniforms will provide guide and information services on board.

It is proposed that parking not be provided within the boundaries of the Park, except for limited administrative parking. This exclusion of parking will serve to keep the boundary of the Park as compact as possible. Thus, maximum commercial and industrial reuse of the remaining portion of the Shipyard can be allowed, which will allow maximum acreage to be added to the city tax roll and provide the greatest potential for jobs to offset the large loss of jobs resulting from the closure of the base.

The Park Service is considering Quarters G (the commandant's House) for exhibition because its architectural features, furnishings of former occupants, and paintings are of historical interest. The Park Service will find appropriate uses for related structures such as: 1 (the entrance gate and garage); 2 (the carriage house); and 245 (a garden shed).

It is the intention of the National Park Service to close Gates 1 and 2 to all vehicular traffic with destinations in the industrial portion of the Shipyard as soon as alternative access can be provided. The historic park setting and the projected visitor-use patterns necessitate that this incompatible use be eliminated. The closure of Gates 1 and 2 to through traffic will necessitate some alternate access routes to the remaining portion of the Navy Yard, to ensure that full and economically viable reuse of the yard can take place.

The National Park Service appreciates and has been sensitive to the need for adequate access to the remaining portion of the Shipyard, and also appreciates the community of Charlestown's desire to eliminate trucking traffic from their streets. Members of the National Park Service have been meeting for some time with city, state and community groups to explore the potential solutions to these problems.

In a March 3, 1974 letter to the Director of the Economic Development and Industrial Commission (EDIC), the Regional Director of the National Park Service stated NPS's policy on access to the northern section of the Naval Shipyard:

"The first step in the program is the development and acceptance of an interim access plan for the industrial park. This plan calls for controlled access through Gate 2 and along Second Avenue and controlled rail access during the period while the Park is under development. This phase will last three years from the first Congressional appropriation of development funds for the Boston National Historical Park.

Step 2 is a development program to be completed by the city and state within the above-stated three-year period to allow the closure of Gates 1 and 2 to through traffic. It consists of a two-way connection between Chelsea and Water Streets and will require the movement of a section of a historic wall and the possible creation of adverse effects on the historic Commandant's quarters.

In addition to our concerns over the loss of Park lands created by the second step and the potential adverse effect on the historic wall, the Commandant's House, and the open space surrounding it, the Chelsea/Water Street connector and a new Little Mystic Bridge also causes us some concern as to the possible adverse intermixing of heavy commercial

trucking traffic and visitor traffic as they would flow through City Square and along Water Street. It is our understanding that the community of Charlestown shares our concern as to the effect of additional commercial traffic through the City Square area."

8.F. BRA Plans for the Northern Shipyard

Initial planning for the reuse of the northern part of the Naval Shipyard was undertaken by EDIC and BRA jointly. The BRA is now planning for the following major uses: several museums and institutions, housing, hotel/convention center, retail and restaurant, marina, and some light industry. The access to this development will be primarily through Gate 5. Parking will be provided on site, some parking may also be provided for the National Park. There is also the possibility of access through Gate 4, particularly for tour buses.

8.G. Evaluation of Effect

8.G.1. Criteria

Three criteria were used to evaluate the road's impact on 106 property:

Physical Alteration: changes caused by the highway may include regrading, removal of vegetation, elements out of character or scale with the existing environment, natural or man-made, the taking of land, and the removal of physical facilities on that land.

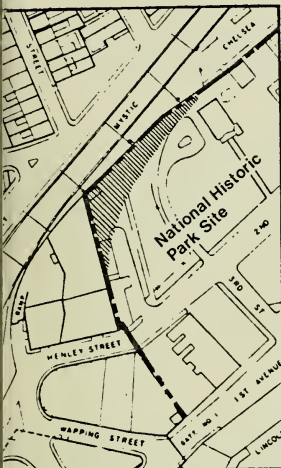
Barrier Effects: a road is in itself a physical and psychological barrier. The question is whether the road disrupts or enhances existing pedestrian vehicular or visual access to a resource.

Effect on Ambient Environment: new construction may present an opportunity to enhance desirable features of land use, landscape, etc., but it may also have a disruptive effect by causing a conflict in use by changing the special character which makes a particular area a valued resource.

8.G.2. Impact of Alternatives

ALTERNATIVE 4 - PREFERRED ALTERNATIVE

Because of the additional taking, impacts on land, wall, and landscaping during construction and operation phases would be slightly more severe, although similar to the impacts of Alternatives 2 and 2A.



Shaded area indicates land of historic value affected by the Build Alternative 4.

Nearly the entire area between Gates 1 and 2 and the existing bridge approach will be used for the Water Street off-ramp and the roadway connecting Water and Chelsea Streets. The ramps will effectively move the expressway structure closer to the Shipyard boundary, within fifty feet at Gate 2.

Table 8.G-1 Shipyard Takings of Alternative 4 (sq.ft.)

	<u>Alt. 4</u>
Inside Wall ¹	12,700
Outside Wall ²	25,100
For Entrance ³	<u>37,100</u>
Total Sq.Ft.	74,800
Total Acres	1.78

Whether the use of the land outside Gates 1 and 2 for roadways constitutes a conflict in use with the Gates will depend upon the National Park Service's final plans for their Park site. The use of either of these Gates as a main entrance would be awkward, but physically possible with Alternative 4. Buildings 204 (garage), 245 (garden shed), and 269 (residential garage) will also be taken. Approximately 12,700 sq.ft. of land will be taken from between the Commandant's House and the granite wall marking the historic boundary of the Shipyard. Four hundred linear feet of the wall will be displaced and rebuilt on a new location. The relocated wall will be approximately five feet from the rear (formerly the front) steps of the house, reducing the lawn area and spatial openness. It is assumed that the wall will be rebuilt to separate the house and Shipyard from the new roadway, so that it can continue to act as a noise barrier (see fig. 8e).

The 10 to 20 shade trees, shrubbery and lawn serve as an important landscape setting for the Commandant's House and this area of the Shipyard, making it appear more "residential". The vegetation also partially blocks the view to the Tobin Bridge to the west. Some of the trees would be replanted nearer to the house. Use of the original house entrance would become of even more limited use than at present. The impact of taking approximately 12,700 sq.ft. inside the wall, which includes most of the existing greenery, cannot be minimized. It would destroy both the sense of enclosure at this end of the Shipyard and the aesthetic relationship of the placement of the wall, the structure and its landscaping.

1. This land is inside the granite wall (1825-6) on Shipyard property adjacent to the Commandant's House.
2. This land is outside the granite wall, but still is Shipyard property.
3. This land is now owned by the Federal Government, but was included in the Congressional authorization for possible acquisition and use for Park entrance purposes.
4. Temporary taking for construction.
5. Does not include temporary taking.

The aesthetic effects of Alternative 4 are quite similar to those of 2 and 2A except that since the Chelsea/Water Streets connector is at-grade, its visual impacts are much reduced. To the casual observer and to the driver, available views of the waterfront and the U.S.S. Constitution will be basically unaffected.

The Tobin Bridge and its approaches present a barrier to pedestrian movement from residential areas of the Shipyard and waterfront. The new road will not appreciably alter this situation. A sidewalk along the connector will permit pedestrian movement where none is now possible. A new crosswalk at Gate 4 will provide access from the Shipyard to the community and Bunker Hill.

A new view of the Shipyard, its granite wall, and the Constitution's masts will be opened by the "T-ramp" feature of this Alternative.

8.H. Measures to Avoid and Reduce Impacts

The measures described here will help to minimize impacts from the Alternative by removing the cause of the impact or by lessening the effect. In addition, other urban design measures may be underwritten by the BRA or National Park Service as part of their plans for improvements to the Shipyard.

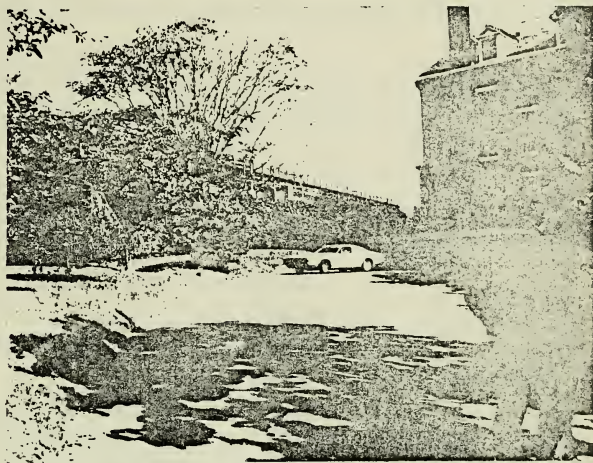
ALTERNATIVE 4 - PREFERRED ALTERNATIVE

Granite Wall. Planting will be the same as for Alternative 2 and 2A inside the Shipyard. Along Chelsea and Water Streets, this Alternative provides more opportunity for at-grade greenery. In this Alternative, it will be necessary for the roadway to use the land now occupied by an 1825-26 granite wall, once the boundary of the Shipyard. This wall will be moved, by cataloguing the stones, storing them, then rebuilding it as a buffer between the Commandant's House and the road. The wall will not be able to be restored to its original condition: mortar will be replaced and the earth and vegetation around it will not have the settled look acquired over decades of weathering. However, the massiveness of the wall, and its ability to close off the yard will not be lost. (See fig 8e.)

Landscaping will be necessary to replace as many of the large trees as possible in order to recreate the tree screen which now partially obscures the expressway. It will take time for these trees to mature, but when they are grown the view of the area from the main Park area to the east will not be noticeably different from today for the casual observer.

Landscaping will also be provided along Water Street on the banks of the ramp and roadway outside Gates 1 and 2. These plantings will soften the visual impact of the roadway and will be in harmony with the plans of the National Park Ser-

ew of the granite wall and
ommandant's House.



osition of the relocated wall for
alternatives 2, 2A, and 4

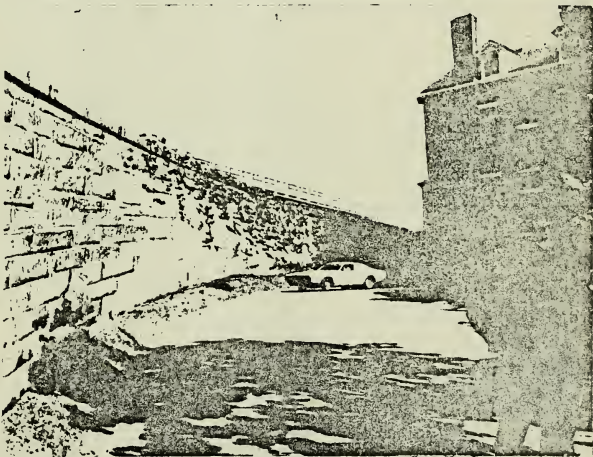


Figure 8e

Relocated Granite Wall

Chelsea-Water Streets Connector · Little Mystic Channel Crossing
Draft Negative Declaration

vice and the BRA. In the same way, plantings should be provided in consultation with NPS and BRA at Gate 4 and along Chelsea Street. Some additional space for entry use will be provided at Gate 4 to improve sight lines and to allow for landscaping. Chelsea Street will be repaired and given new curbs and sidewalks.

Pedestrian Access. A new at-grade pedestrian crossing will be provided at Gate 4 to connect the new Park with the community. This crossing will alleviate the effect of increased traffic on Chelsea Street. Further study should be made of the use of the existing pedestrian underpass across from the Bunker Hill Pavilion on Water Street. It will need to be either replaced, possibly with a walkway along Gray Street, or redesigned to lead the pedestrian from the tunnel to a new crossing of Water Street.

CONSTRUCTION PERIOD

Standard precautions will be taken during construction to minimize noise, dust, erosion, and disruption of traffic patterns. These measures include:

- . Staging and timing of construction will be planned to minimize traffic disruption.
- . Uses of dikes to control bank erosion at the bridge abutments and adjoining areas.
- . Land disposal site for spoil materials from dredging Little Mystic Channel or arrangements for disposal in the "Foul Area" at longitude 70 degrees 34.5'W and latitude 42 degrees 25.5'N.
- . Mats, dampening and other measures will be used to control dust generation at construction sites.
- . All equipment and procedures will conform to the City of Boston's ordinance regulating noise, air pollution and other aspects of construction operations.
- . Following completion, excess land can be passed to the National Park as a measure to reduce impacts.

8.1. Urban Design Possibilities

Urban design studies exploring landscaping, pedestrian paths and Shipyard entrance treatments have been prepared for each Alternative. These studies show possible relationships between transportation improvements and known requirements of development plans for the northern Shipyard and the National Park (both still in the planning stage). Particular attention has been paid to avoiding roadway alignments which restrict entrance options to these new attractions.

It should be noted that these investigations are not intended to be part of the Alternatives; neither are they to be considered as "measures to avoid and reduce impacts" nor "joint development" proposals. Their development depends upon the plans of the BRA and NPS and are intended to serve as examples of possible approaches.

The purpose of these suggested urban design elements is to provide an approach to the new Park for the pedestrian, both resident and tourist; to extend the open space of the Park and northern Shipyard development into the community; and to create a suitable visual entry to the Park for all visitors.

Urban design suggestions for the treatment of Water Street, Gates 1 and 2, Chelsea Street, and Gates 4 and 5 are described below, and are illustrated in Figures 5p and 5q.

PEDESTRIANS

Several elements are already in place or planned, which could form a pedestrian loop from the Park to Bunker Hill, to Winthrop Square, to the Bunker Hill Pavilion and back to the Park. On a larger scale, the Paul Revere Landing Park could be linked to the new National Park along Water Street, and a path could continue along the waterfront, through Gate 5 to Barry Playground and then over the bridge to Park land and the boat ramp on the Moran Terminal side of the channel. The pedestrian walkways suggested in these urban design possibilities contribute to the completion of this overall scheme.

WATER STREET

The sidewalk would be widened on the south side of Water Street and landscaped with street trees. An enlarged pedestrian way under the bridge approach would be provided at Gray Street to create a safer and more pleasant path for pedestrians. The new crosswalk to be provided in the building of the link would connect this walkway to the sidewalk at a signalled crossing.

GATE 1

The widened sidewalk on Chelsea Street would continue into Gate 1. Pedestrians could also follow the walk along the railroad tracks behind the Bunker Hill Pavilion to the Constitution. There would be access for service vehicles over the paved area for pedestrians to Gate 1. There would be a pedestrian walkway adjacent to the granite wall connecting Gates 1 and 4 along the connector. This sidewalk would be provided as part of each Alternative. Landscaping along the roadway and at the entrance would also be provided as a measure to reduce impacts.

GATE 2

Although this gate would most likely be closed in all Alternatives, there will be the option to open it for pedestrian access.

GATE 4

Chelsea Street could be aligned differently than shown in the Alternatives by keeping it immediately adjacent to the Tobin Bridge structure joining with existing Chelsea Street at Vine Street. This would allow more room at Gate 4 to create a suitable service and/or pedestrian entrance for the Park and activities in the northern part of the Shipyard. The space could be used for planting, signs, special paving, and sight distance. Near Gate 4 there would be a signalized pedestrian crosswalk to connect the Park with pedestrian paths to Bunker Hill, to parking under the Tobin Bridge and to the community of Charlestown.

The connector roadway would be below grade at Gate 4, creating an embankment, rather than a level area at the entrance. The sidewalk from Gate 1 and the crosswalk would remain.

GATE 5

There would be signalized crosswalk at Gate 5 to connect the sidewalk to the northern Shipyard.

CHELSEA STREET

Realignment of the street would require the use of some Boston Housing Authority land between the existing street and the Tobin Bridge. As in the Alternatives under study, the street would be repaved as part of the construction of the proposed project and a widened walkway would be provided on the parking lot side. The lots under the bridge would be landscaped and the small streets between them closed to traffic and used only for access to the parking lot. Bunker Hill Street would also be closed.

8.J. Agency Coordination

During the preparation of this Draft Negative Declaration, there were several informational meetings with the State Historic Preservation Officer (SHPO) who is director of the Massachusetts Historic Commission. That office has been asked to review the preliminary DEIS. The President's Advisory Council on Historic Preservation's New England representative has toured the Shipyard site on August 1, 1975, and has reviewed the design Alternatives. Correspondence from this agency is attached. Official 106 consultation procedures have already begun.

K.L.

**Advisory Council
On Historic Preservation**

1522 K Street N.W.

Washington, D.C. 20005

October 24, 1975

Mr. George R. Turner, Jr.
Division Engineer
U.S. Department of Transportation
Federal Highway Administration
Region One
612 J.F.K. Federal Building
Boston, Massachusetts 02203

RECEIVED

OCT 30 1975

WALLACE FLOYD ELLENZWEIG MOORE INC.

Dear Mr. Turner:

In response to a request from the National Park Service (NPS) on August 1, 1975, Myra Harrison of my staff went to Boston to discuss several projects that will affect the Boston Naval Shipyard. As you know, a portion of the shipyard will be transferred to the NPS for administration as a National Historical Park. One of the meetings was with representatives of the Boston Redevelopment Authority (BRA) and the NPS for a briefing by David Wallace of Wallace, Floyd, Ellenzweig and Moore Inc. on the alternatives for the proposed improvements to Chelsea Street, a project to be funded by the Federal Highway Administration (FHWA) that will affect the shipyard.

This office was first contacted on this project in 1972, when the Chelsea Street improvements were included in the larger North Terminal Study Area Project. By letter of November 27, 1972, you requested the Council's comments under Section 106 on the effects of the project on the shipyard. Our office responded on January 17, 1973, and asked for a preliminary case report prior to any consultations. A preliminary case report was prepared and on September 20, 1973, your office requested that on September 24 Ms. Harrison represent the Council at an on-site inspection in Boston with FHWA and the Massachusetts Historic Preservation Officer (HPO). The meetings concluded without resolving any of the historic preservation issues involved, because the NPS had not been consulted on the project, and also the future of the project was uncertain. In response to a July 15, 1974, query from this office on the project's status, you informed us on August 5, 1974, that the North Terminal project was at a standstill, and then on October 23, 1974, you wrote that the Chelsea Street portion of the project has been revived and that consultations under the Council's procedures would be needed in the future. We have had no direct contact from your office since that letter.

Mr. Wallace informs us that his firm is preparing the draft environmental statement for this project and that the statement should be

completed by the end of this month. As the Council's procedures state that every effort should be made to yield in the environmental statement a single document evidencing compliance with all applicable environmental authorities, we would like to coordinate closely with you to complete compliance with our procedures before the publication of the final statement. Therefore, FHWA should send the Council notification that the case has been reopened, and should provide this office with an up-date on the preliminary case report prepared in 1973.

In preparing the updated case report, FHWA should coordinate with the NPS and the HPO. The HPO should be contacted to learn if she has any particular questions that should be addressed in your update. The NPS should be contacted for the same purpose, because any improvements to Chelsea Street will affect the park, and any that result in the taking of land from the park or the temporary removal of the stone wall will require a Special Use Permit. The Council would prefer to sign one Memorandum of Agreement for the total project, with both NPS and FHWA as signatories. As the Federal agency sponsoring the project and preparing the EIS, FHWA should assume the role of "lead agency" for purposes of compliance with the Council's procedures.

The Council has not changed its requirements for the content of the preliminary case report since the last one was prepared for this project. A list of those requirements is appended for your convenience. To further assist you in this revision, we would request that the following issues be addressed:

Tunnel Scheme (Alternative 4-c):

what would be the distance between the highway and the gate area?

how would the gate and its use be affected?

what landscaping and other treatments might be used to minimize impact on the gate area?

which trees would have to be lost, which trees could be moved for the duration of the cut and cover operation and later replaced?

Parkland Taking Scheme (Alternative 2):

how far from the Commandant's house would the wall be relocated and what landscaping elements would be lost?

what possibilities exist for mitigating the impact of this scheme on the Commandant's house?

what possibilities exist for mitigating the impact on the rest of the park of the wall relocation?

what compensation can be offered the NPS for the land that will be lost?

As mentioned earlier, FHWA should directly solicit the views of the NPS on this matter. However, at the time of the August briefing, the NPS representatives mentioned the following concerns:

how much would Scheme 2-c cut into the park, and how would it affect Gate 2?

what kind of vibrations would be generated by each of the proposed schemes?

what would the impact be on the historic scene:
what would the visitor see from different vantage points within the park? in particular, what would be the appearance of Gates 1 and 2?

At the August meeting, the NPS representatives also stated that a detailed historical study of the shipyard area would be commencing in October, and that the portions of the shipyard would be affected by the FHWA proposals would be studied first.

Thank you for your continued cooperation. If we may be of any assistance, please do not hesitate to contact us.

Sincerely yours,

John D. McDermott
Director, Office of Review and
Compliance



IN REPLY REFER TO:

L1425-NAR (L)

United States Department of the Interior

NATIONAL PARK SERVICE

NORTH ATLANTIC REGION

150 CAUSEWAY STREET

BOSTON, MA. 02114

November 10, 1975

RECEIVED

NOV 12 1975

BOSTON REDEVELOPMENT AUTHORITY
OFFICE OF THE DIRECTOR

Mr. Robert T. Kenney
Director
Boston Redevelopment Authority
City Hall
One City Hall Square
Boston, Massachusetts 02201

Dear Mr. Kenney:

Public Law 93-431, approved October 1, 1974, authorized the establishment of the Boston National Historical Park. One of the areas included in the Boston National Historical Park is the Charlestown Navy Yard. Approximately 27 acres of land and land under water under the administration and control of the Department of the Navy is to be transferred to the National Park Service.

The above legislation also authorizes the acquisition of certain property at the entrance to Gate No. 1 of the Charlestown Navy Yard. Enclosed is a map depicting in red the property to be acquired and included within the shipyard area. Shaded in red on the map are three tracts of land recently acquired by the Boston Redevelopment Authority and designated as Tract 41-1, 2 and 4, Tract 51-2 and Tract 52-2. The portion of these properties not needed for an interchange or to provide access to the remainder of the Navy Yard is required to protect the integrity of the national historical area.

Funds are not available as yet for the acquisition of these tracts. However, it is requested that you include for our use that portion of these tracts not required for access to the rear portion of the Navy Yard.

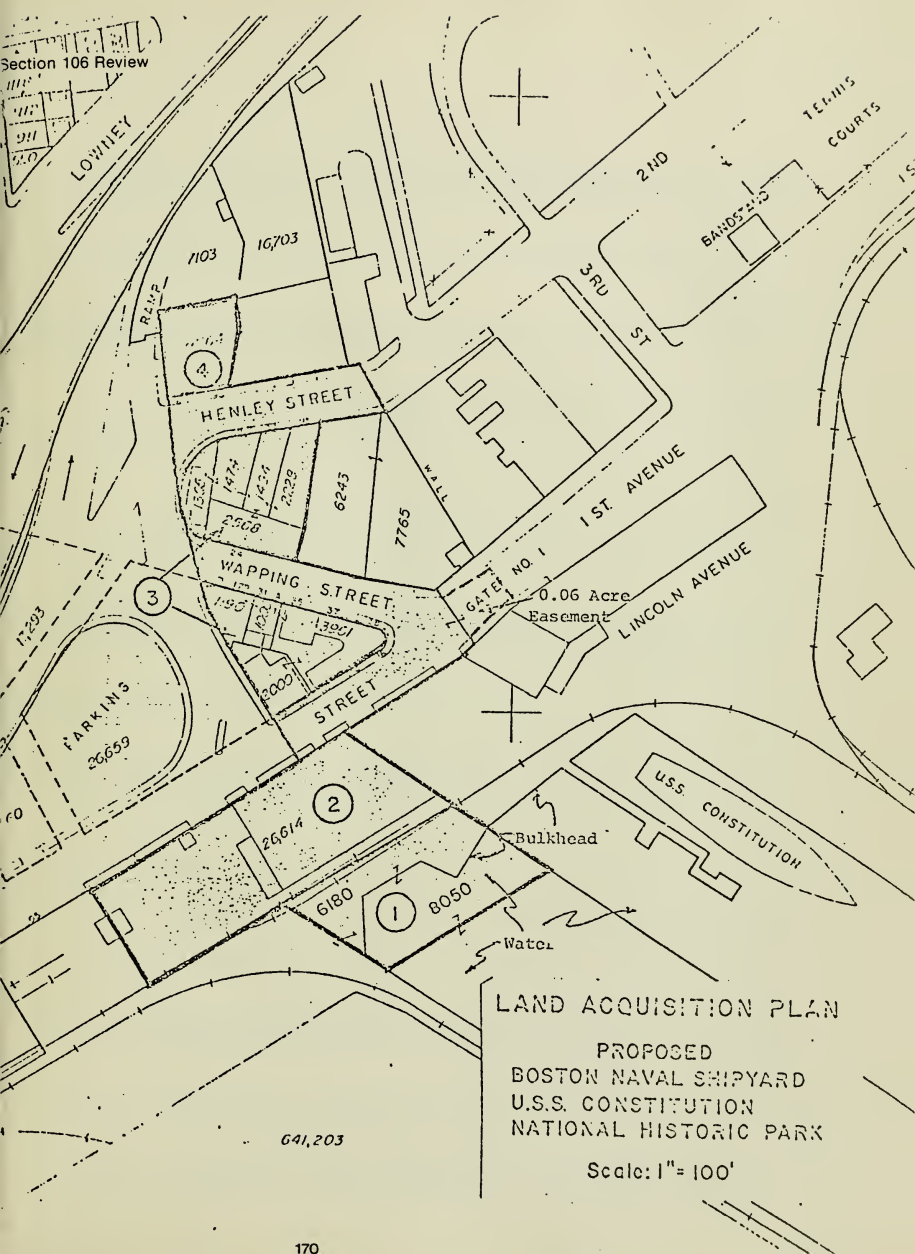
If you have any questions concerning the above, please contact me.

Sincerely yours,

James D. Wagers
James D. Wagers
Regional Director

Enclosure





LAND ACQUISITION PLAN

PROPOSED
BOSTON NAVAL SHIPYARD
U.S.S. CONSTITUTION
NATIONAL HISTORIC PARK

Scale: 1" = 100'

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2. Boston Redevelopment Authority, The Ropewalk in the Charlestown Navy Yard, 1974
3. Bryan, John Merrill, Boston's Granite Architecture, C. 1810-1960 Ph.D. dissertation, Boston University, Boston, Massachusetts, 1971.
4. Bunting, W.H., Portrait of a Port: Boston, 1852 - 1914, Belknap Press of Harvard University Press, Cambridge, 1971.
5. Cook, H.E., Captain, U.S. Navy, Outline History of the Navy Yard, Manuscript, Boston, 1934.
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7. Drake, Samuel A. Historic Mansions and Highways Around Boston, Rutland, Vermont: Charles & Tuttle, Co., 1972, a revised edition of Old Landmarks and Historic Personages of Boston. Boston: Little Brown, 1973.
8. Hanlin, P.W., Lt. J.G., History of the Boston Navy Yard, 1800-193 Manuscript, Boston, 1937
9. Huxtable, Ada Louise, "Granite Wharf, Warehouses, Office Buildings C. 1923-1972, Boston, Massachusetts: Alexander Parris, G.J. Bryant, Others, Architects," Progressive Architecture, June, 1958, pp. 117-118.
10. Mansfield, George O.Q., Historical Review, Boston Navy Shipyard,
11. Mayor's Office of Commerce and Manpower, "Preliminary Data/Boston Naval Shipyard and South Boston Naval Annex." Boston, 1973.
12. "Planning Study - Boston National Historic Sites." Eastern Service Center, National Park Service, 1971.
13. Public, Commodore George Henry, History of the Boston Navy Yard 1797-1874, (unpublished, National Archives No. 118 microfilm transcript, 1875)
14. Nation Park Service, "New Area Study for Boston Naval Shipyard National Historic Site, Boston, Massachusetts, August, 1973."
15. U.S. Department of the Navy, Boston Naval Shipyard, Department of Public Works files: "Shipyard Plans", "Boundary", "Fences", "Gates", "Officers Quarters", "Commandant's House."

16. Winsor, Justin, ed., Memorial History of Boston: 1630-1880, Boston, 1882, Vol. III contains chapter by G.H. Preble, "The Navy and the Charlestown Navy Yard."
17. Whitehill, Walter Muir, Boston: A Topographical History. Revised edition, Cambridge, 1968.

FROM THE NATIONAL PARK SERVICE

"New Area Master Plan for Boston Naval Shipyard, USS Constitution National Historic Site", Boston, Mass.(1974/1975)

NPS Boston Nat'l Historical Park Planning Directive,
(Dec. 13, 1974).

"An Alternative for Development: Boston Naval Shipyard",
(March 1975).

"Master Plan: Alternatives for Boston National Historical Park" (revised June 23, 1975).

MEETINGS

May 22, 1975 WFEM, NPS

Subject: NPS major concern of separation of Park and
truck traffic

June 3, 1975 WFEM, BRA, NPS

Subject: Land exchange plans and McDonald's food store.

July 14, 1975 WFEM, Hugh Gurney of NPS

Subject: Review preliminary design alternatives and
approach to the Section 106 Review and Kennedy
Museum

August 8, 1975 NPS, BRA, J.F.Kennedy Corporation

Subject: Joint planning issues and discussion of schedule

CORRESPONDENCE

March 3, 1975: letter from Jerry D. Wagers, Regional
Director, NPS, to Gerald W. Bush, EDIC

Subject: Speaks of NPS sensitivity to access needs of
Northern Shipyard and describes the NPS planning
process

March 10, 1975: letter from Elizabeth R. Amadon to Robert
Tierney, MDPW

Subject: Requests consultation with advisory council be-
fore commenting on the preliminary DEIS

Oct. 21, 1975: letter from Alfred R. Howard, BRA, to Hugh
D. Gurney

Subject: Discusses the purpose of the Chelsea Water Im-
provements and invites him to the fourth public
meeting on Oct. 30. He describes alternatives
and requests comments.

Oct. 24, 1975: letter from John D. McDermott to George
Turner, FHWA

Subject: Advisory Council concerns were outlined and an
August 1, 1975, visit by Myra Harrison described.

Nov. 20, 1975: review copy of DEIS from WFEM to Elizabeth R. Amadon

Subject: Asking her to review the preliminary DEIS

Dec. 3, 1975: letter from Elizabeth R. Amadon to Becky Livengood

Subject: contained review comments on Draft EIS

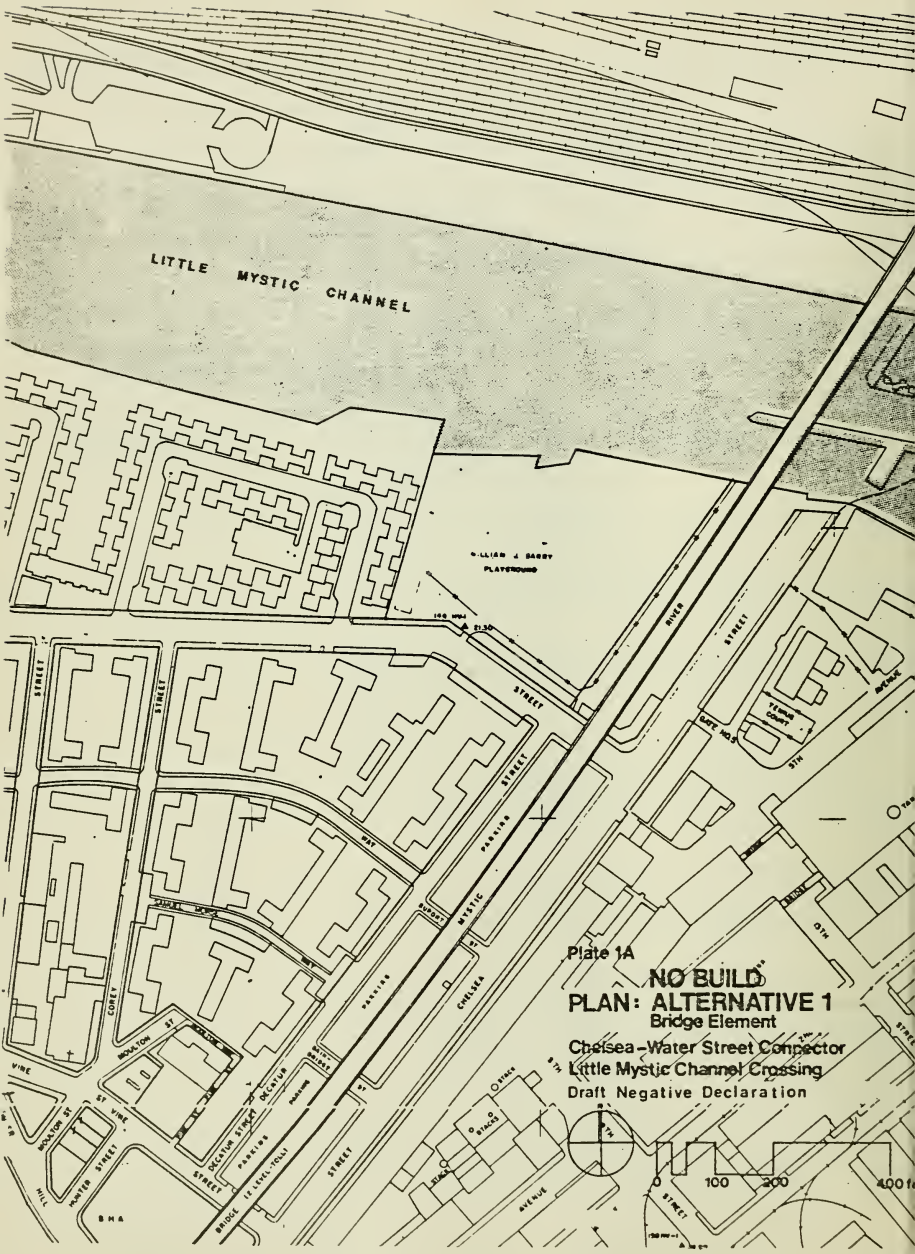
PUBLIC MEETINGS

June 5, 1975: to review Phase I Report range of alternatives

July 17, 1975: to report on progress of the study and to listen to questions and comments of the Charlestown residents

Sept. 3, 1975: to present the alternative designs which will be analyzed for their impact on the environment and to answer any questions on the study

Oct. 30, 1975: Community presentation of DEIS



LITTLE MYSTIC CHANNEL

WILLIAM J. BARRY
PLAYGROUND

Plate 1A

NO BUILD
PLAN: ALTERNATIVE 1
Bridge Element

Chelsea-Water Street Connector
Little Mystic Channel Crossing
Draft Negative Declaration



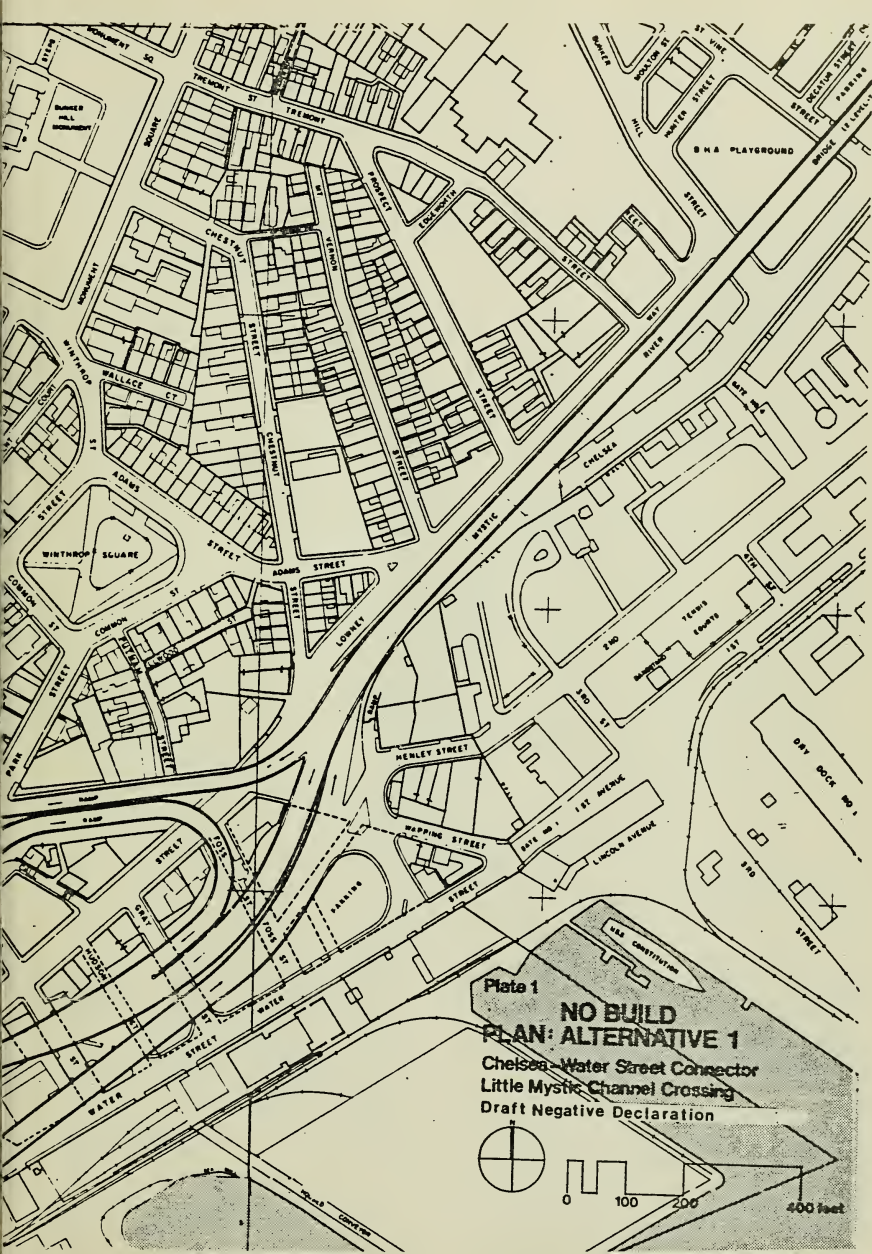


PLATE 2-P

PROFILE: ALTERNATIVE 2

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

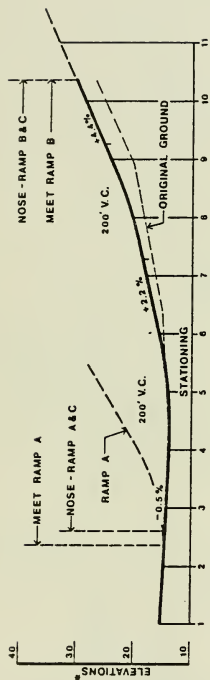
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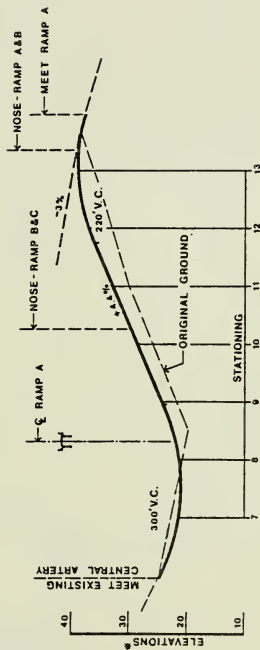
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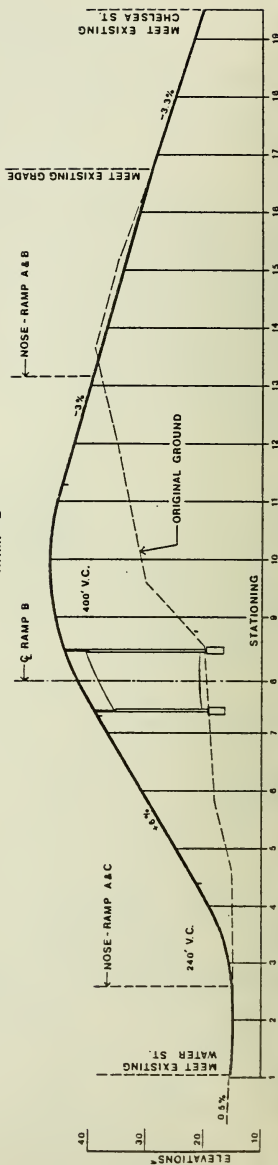
▲ ELEVATIONS USING
 CITY OF BOSTON BASE



RAMP C



RAMP B



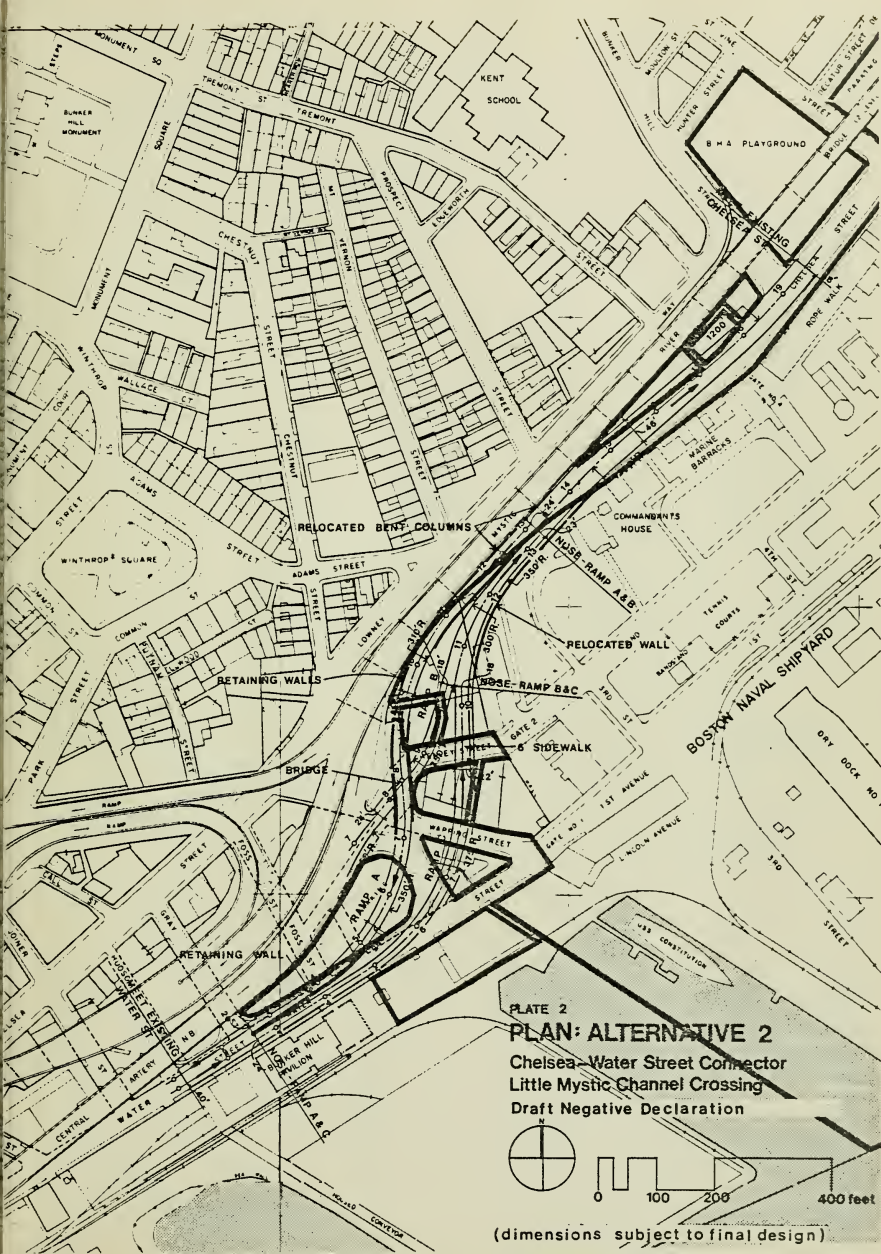


PLATE 2

PLAN: ALTERNATIVE 2

Chelsea Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration



0 100 200 400 feet

(dimensions subject to final design)



(dimensions subject to final design)

ELEVATIONS USING
CITY OF BOSTON BASE

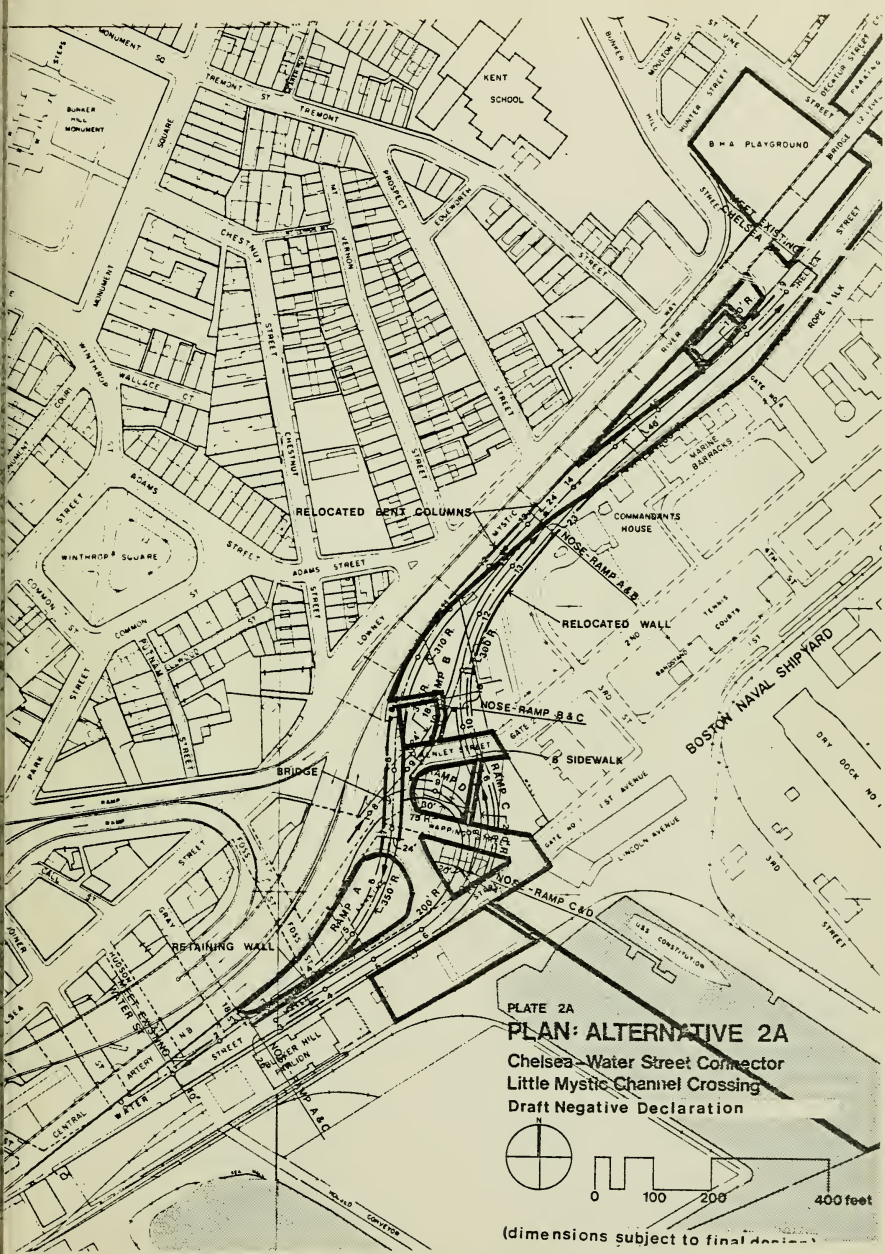


PLATE 3P

PROFILE: ALTERNATIVE 3

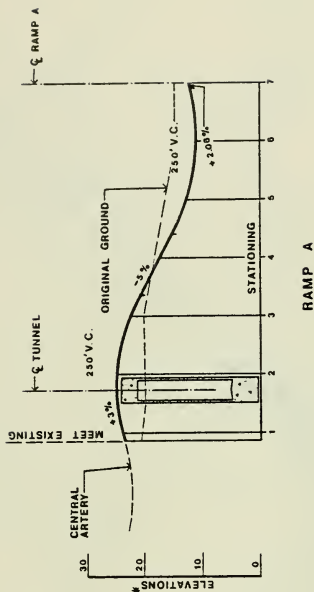
Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

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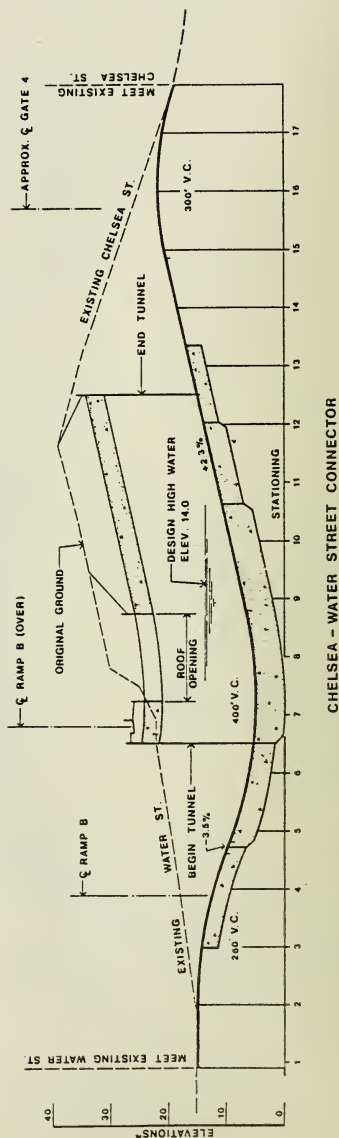
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* ELEVATIONS USING
 CITY OF BOSTON BASE



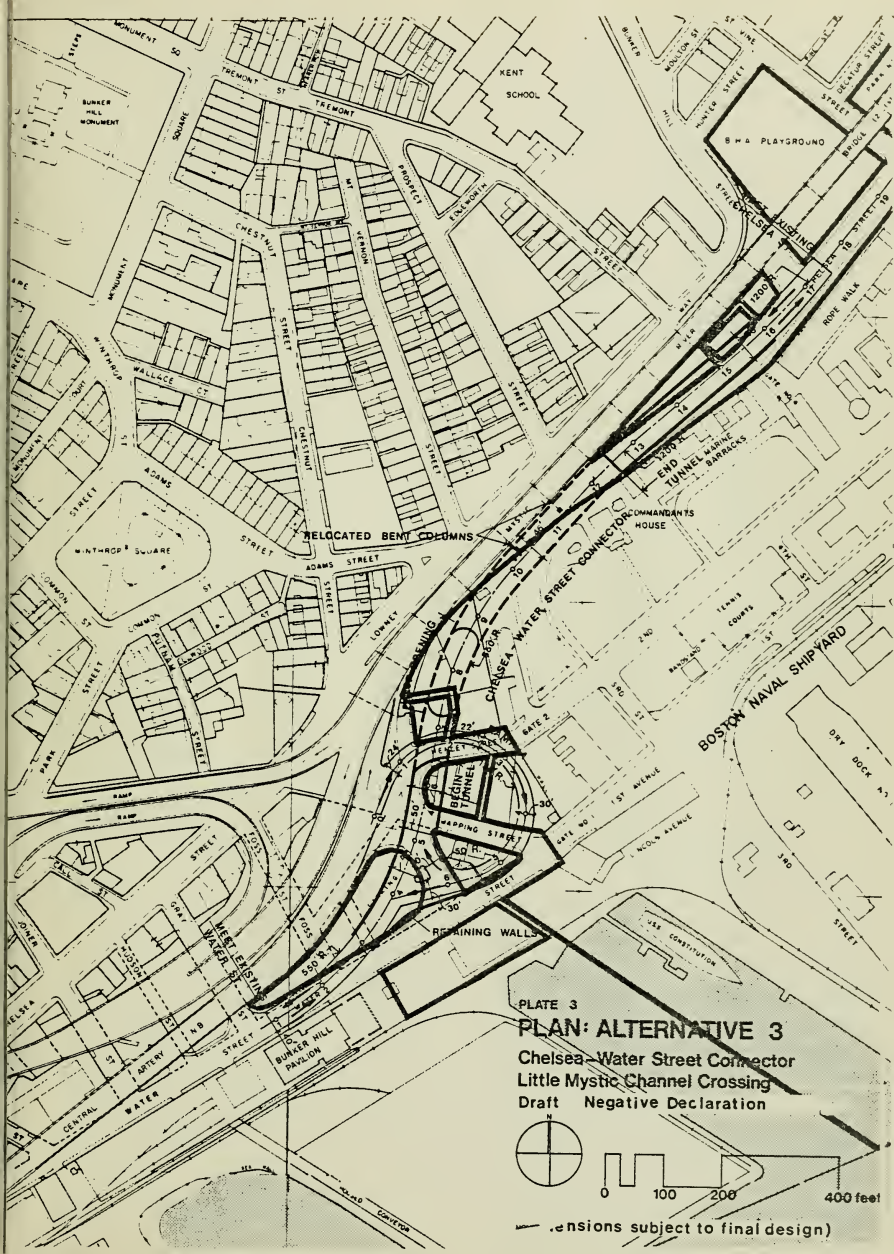
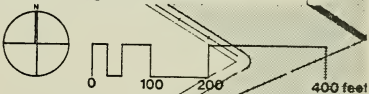


PLATE 3

PLAN: ALTERNATIVE 3

Chelsea Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration



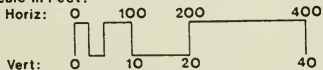
Dimensions subject to final design

PLATE 4-P

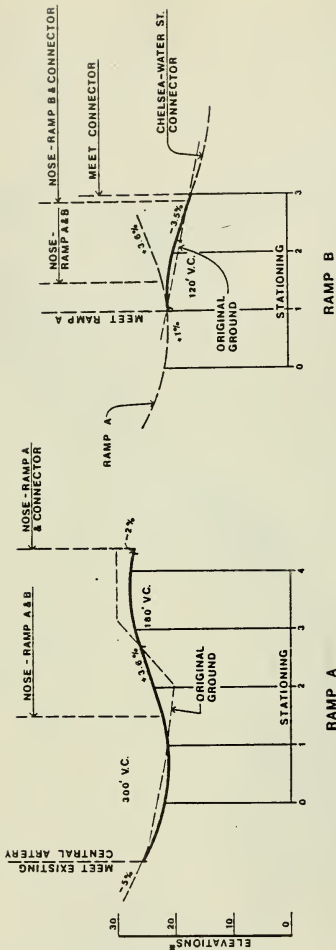
PROFILE: ALTERNATIVE 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

Scale In Feet:



(dimensions subject to final design)



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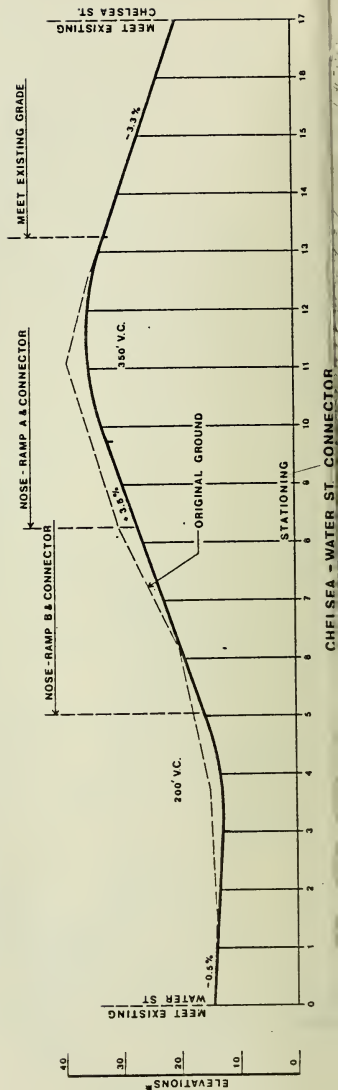


PLATE 5-P

PROFILE: CURVED BRIDGE

(Alternatives 2, 2A, 3, & 4)

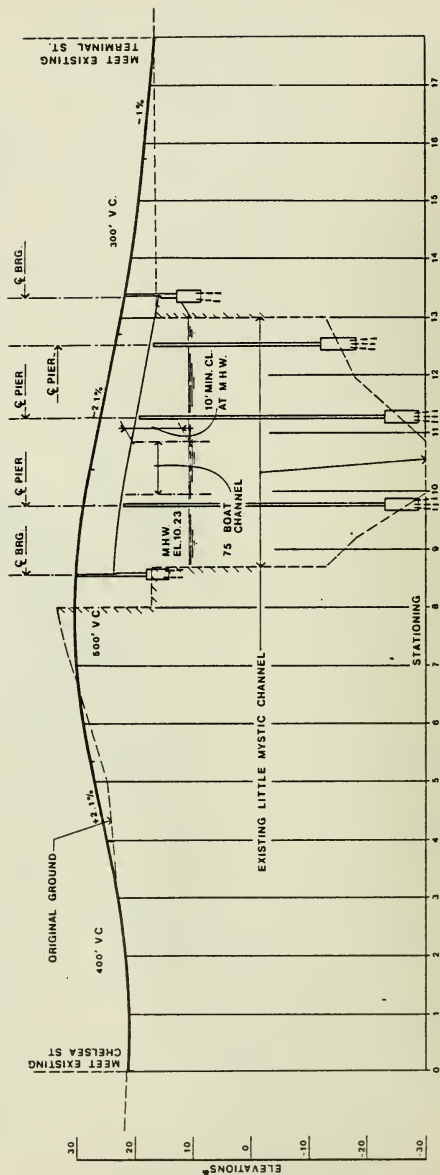
Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

Scale In Feet:



(dimensions subject to final design)

*ELEVATIONS USING
 CITY OF BOSTON DATUM



PROFILE - CHELSEA STREET

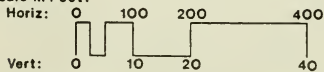
PLATE 6-P

PROFILE: STRAIGHT BRIDGE

(Alternatives 2, 2A, 3, 4)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

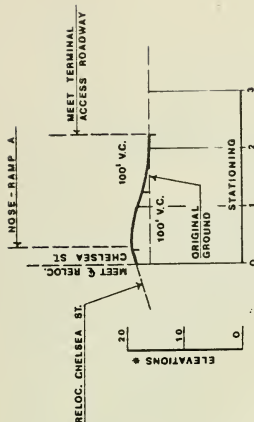
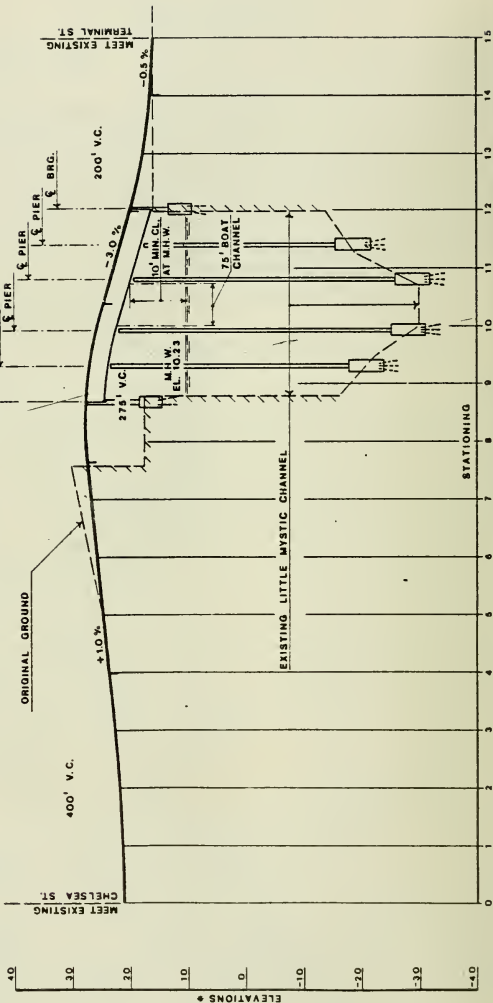
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* ELEVATIONS USING
 CITY OF BOSTON DATUM

RAMP A



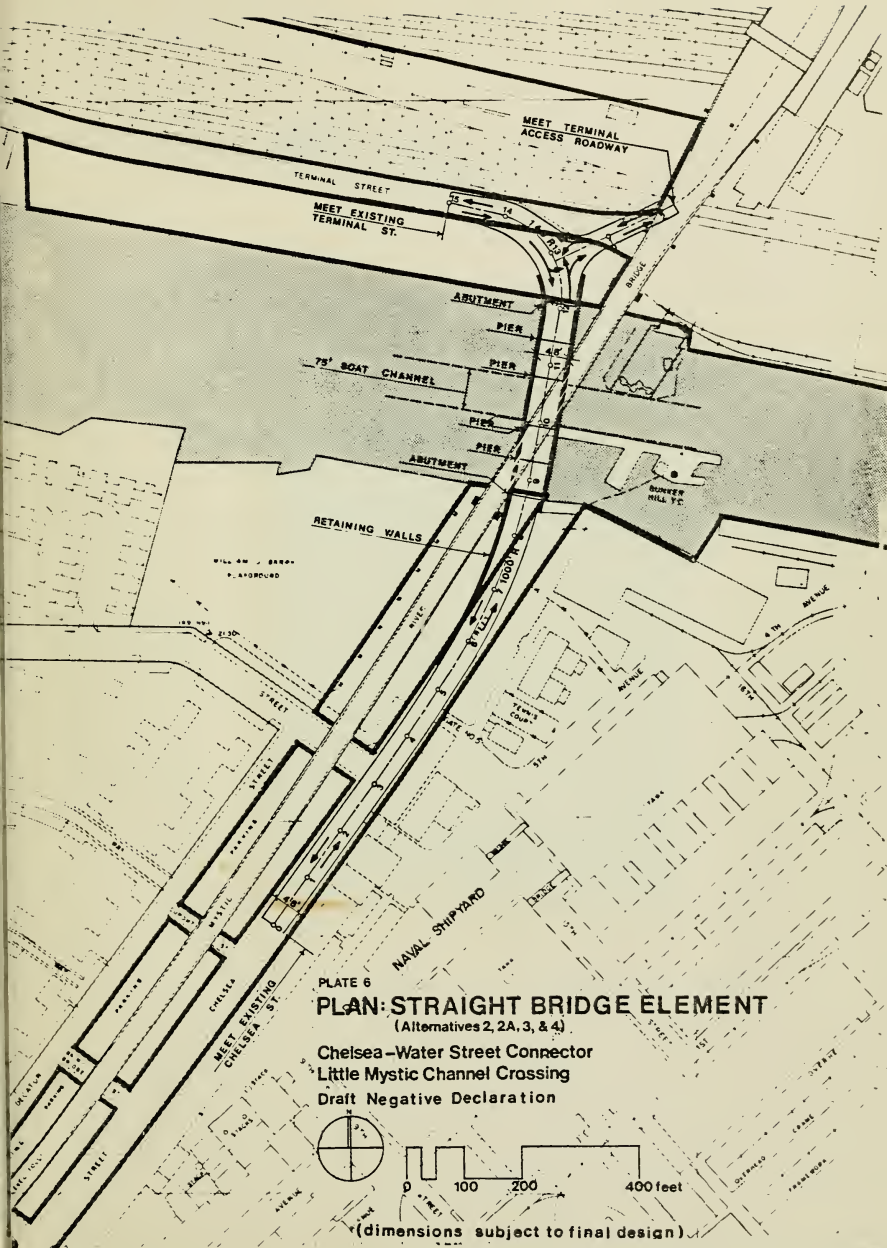


PLATE 6

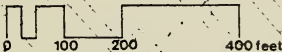
PLAN: STRAIGHT BRIDGE ELEMENT

(Alternatives 2, 2A, 3, & 4)

Chelsea-Water Street Connector

Little Mystic Channel Crossing

Draft Negative Declaration



(dimensions subject to final design)

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CHARLESTOWN U73T.C
U.S. Dept. of Transporta-
tion and Mass. Dept. of
Public Works.
Chelsea-Water Streets
Connector, Little Mystic
~~Channel Crossing~~
DATE ISSUED TO

Charlestown U73T.C
U.S. Dept. of Transportation and
Mass. Dept. of Public Works

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Library



BRA
468
Appendix

Draft Negative Declaration

APPENDIX

BOSTON PUBLIC LIBRARY

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BOSTON REDEVELOPMENT AUTHORITY
Library

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Charlestown, Boston, Massachusetts

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BOSTON REDEVELOPMENT AUTHORITY
Library

Charlestown
U 73 IC
Appendix

U.S. Department of Transportation
Federal Highway Administration
Massachusetts Department of Public Works



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CHELSEA - WATER STREETS CONNECTOR
LITTLE MYSTIC CHANNEL CROSSING
CHARLESTOWN, BOSTON, MASSACHUSETTS

ADMINISTRATIVE ACTION
DRAFT
NEGATIVE DECLARATION
APPENDIX
U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration
AND
COMMONWEALTH OF MASSACHUSETTS
Department of Public Works

Submitted pursuant to 42 U.S.C. 4332(2) (c),
23 U.S.C. 128 (a) 49 U.S.C. 1653(f)
and 16 U.S.C. 470(f)

June 17, 1977
Date

Robert T. Tierney
Robert T. Tierney, Chief Engineer
Mass. Department of Public Works

John J. Carroll
John J. Carroll, Commissioner
Mass. Department of Public Works

Edwin P. Halahan
for Norman J. Van Ness, Division
Administrator
Federal Highway Administration



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230	H: Economic and Social Data
244	I: Land Ownership
249	J: Urban Design Alternatives
253	K: Coast Guard Correspondence
257	L: Affected Shipyard Vegetation

APPENDIX A

DRAFT ENVIRONMENTAL IMPACT STATEMENT
PHASE I REPORT
AN OVERVIEW OF TRANSPORTATION PLANNING
ALTERNATIVES
FOR
PROPOSED CHELSEA-WATER STREET CONNECTION AND
LITTLE MYSTIC CHANNEL CROSSING

Prepared by
The Boston Redevelopment Authority
Massachusetts Port Authority
Wallace, Floyd, Ellenzweig, Moore, Inc.

October 7, 1975

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Introduction

The Boston Redevelopment Authority (BRA) and the Massachusetts Port Authority (MPA) have identified the need for certain transportation improvements in Charlestown. Both agencies have determined through public meetings and contact with individual residents and businessmen that the proposed Chelsea-Water Street Connection and Little Mystic Channel crossing are strongly desired by the people of Charlestown. For these reasons, the BRA and MPA have agreed to carry out in coordination with the Massachusetts Department of Public Works (MDPW) and the Federal Highway Administration (FHWA) the procedures required for preparation of an Environmental Impact Statement on the proposed improvements.

The BRA and MPA have retained a consultant, Wallace, Floyd, Ellenzweig, Moore, Inc. to produce design studies and an environmental assessment leading to a Draft Environmental Impact Statement (DEIS) and to present it to the community for its comments through a series of public meetings. The study is to be done in accordance with the three-phase environmental planning format established by MDPW. A public hearing will be held in accordance with MDPW procedures 45 days after formal circulation of the Draft EIS. MDPW, in consultation with FHWA, will evaluate comments received at the public hearing, and comments received from circulation of the Draft EIS, in the preparation of a Final EIS. The Final EIS will be prepared by BRA and MPA to be circulated in accordance with MDPW and FHWA procedures.

Purpose of the Present Study

Charlestown has a significant problem of trucks on local streets. The DEIS will examine a number of alternative solutions to the problem, and evaluate them for their impacts on the community and the environment, their cost, and their effectiveness.

As proposed, the Little Mystic Bridge will establish a by-pass route for industrial traffic, removing trucks and other extraneous through-traffic from that section of Medford Street between the proposed high school and

Charles Newtown. The proposed Chelsea-Water Street Connection will remove trucks from Lowney Way and its bordering residential streets and improve access to the northern portion of the Navy Yard and National Park site.

Following is a summarization of the reasons for undertaking the DEIS and a brief explanation of the positive benefits expected to be derived from the proposed improvements:

1. Public support for a new low-level bridge across the Little Mystic Channel appears to be strong.
 - a. The new bridge would create a by-pass route for industrial traffic removing trucks and other vehicles from that section of Medford Street between the proposed Charlestown High School (at the intersection of Medford and Terminal Streets) and the existing housing on Medford Street near Chelsea Street. This is the highest density residential area in Charlestown.
2. An expression of positive support for a new channel crossing has also come from several public agencies including the Boston Shippers Association, the Boston Harbor Associates and others.
 - a. The bridge facility would provide improved access and traffic circulation in and out of the Moran Container Terminal.
 - b. Better access and planned expansion of container freight operations will provide more jobs for Charlestown and other City of Boston residents.
3. The Chelsea-Water Street Connection will remove truck traffic from Lowney Way and adjacent local streets.
 - a. Without this new street connection, an increase in industrial traffic could be expected along Lowney Way. This increase in truck traffic on a local street running over a steeply sloping hill and bordering an otherwise attractive historically-valued neighborhood make it highly desirable to provide an alternative, more direct truck route.

The Chelsea-Water Street Connection would provide this opportunity.

- b. The Chelsea-Water Street Connection, as originally proposed in the navy base reconversion study, would provide for improved access to the northern sector of the Navy Yard through Gate 5 and allow traffic to be routed around the periphery and not through the National Park site.
- c. This connection could also provide satisfactory access to the National Park itself by creating a new entrance point from Chelsea Street in the vicinity of Gate Number 4. This would relieve traffic pressures on existing entranceways at Gates Numbers 1 and 2 in the City Square area.

A significant effort will be made to identify actions which can be undertaken to minimize any adverse effects of the project. In cooperation with the National Park Service, the study team will examine relocation possibilities for the Naval Shipyard wall and other measures to minimize impact on the Commandant's House. The intent is to keep all takings to a minimum and to enhance, not disturb, the overall historical character of the area.

An analysis will be performed to determine traffic patterns in the area to be served by the proposed transportation improvements. Discussion of traffic implications will be presented in the DEIS, including possible relocation of the existing City Square off-ramp at Water Street to a point further north. The proposed off-ramp would extend from the Tobin Bridge to Chelsea Street. The design provides relief to Lowney Way and City Square and by-passes traffic away from the park and historic sites.

Project Goals

Present indications are that the Charlestown Community will benefit from the proposed transportation improvements. The project goals may be identified briefly, as follows:

1. Create a truck by-pass route which will serve the local community by removing commercial and through-traffic from local residential streets particularly Medford and Lowney Way with their adjacent, residential, school and recreational land uses.
2. Provide improved access to Moran Terminal.
3. Improve access to the northern sector of the Navy Base, consistent with future land use reconversion plans.
4. Route traffic around the periphery of the National Park and lift the burden for improved access to the northern sector of the Navy Yard from existing Park entranceways.

Current Transportation Plans

WFEM has participated in the three most recent studies of the area under consideration: the North Terminal Draft Environmental Impact Statement, the Land Use and Transportation Study of the Boston Naval Shipyard, and the Central Artery Depression Feasibility Study. Nearly all of the subconsultants also participated in these studies. Edwards and Kelcey are engineers to the BRA for the Charlestown Urban Renewal Project and the City Square traffic improvements.

Material available from the above studies has been updated, as necessary. Additional data will be collected as needed for areas which could be impacted by the proposed construction. The following is a summary of transportation projects or proposals pertinent to establishing the context in which the proposed transportation improvements will be carried forward.

A. City Square

Plans to improve the flow of traffic in City Square are being developed by the City of Boston and Massachusetts Department of Public Works. These improvements will be compatible with the proposed Chelsea-Water Street Connection and will assist in providing improved access to the National

Park and northern sector of the Navy Yard. City Square plans calling for an improved Joiner Street and the Chelsea-Water Street Connection are both supportive of the Little Mystic Bridge proposal.

B. North Terminal Area Study

The recent DEIS evaluated several schemes for improving traffic safety and reducing congestion in the North Terminal area. Extensive roadway improvements to I-93, Tobin Bridge and Central Artery were evaluated as to their probable environmental impacts. One scheme involving scissor ramps from the Tobin Bridge and new surface street improvements would affect the Chelsea-Water Street Connection. None of the suggested North Terminal improvements would restrict a low-level bridge across the Little Mystic Channel.

The Charlestown community strongly opposed the scissors ramp concept and the use of Lowney Way in a one-way pair operation. In contrast, the Chelsea-Water Connection is acceptable to the community and, if implemented, would virtually eliminate the scissors ramp concept from further consideration. No final choice will be made among proposed North Terminal alternatives until completion of the feasibility study for depression of the Central Artery. A policy decision made during the course of the North Terminal DEIS that no residential takings in Charlestown would take place remains in effect.

C. Orange Line Elevated

The new Orange Line serving Bunker Hill Community College is now open. It replaces the old elevated structure which crossed the Charlestown Bridge, passed through City Square and up Main Street to Sullivan Square and beyond.

Access to and from the rapid transit

and buses at new Sullivan and Community College Stations will be enhanced by the proposed Chelsea-Water Street Connection and general City Square improvements.

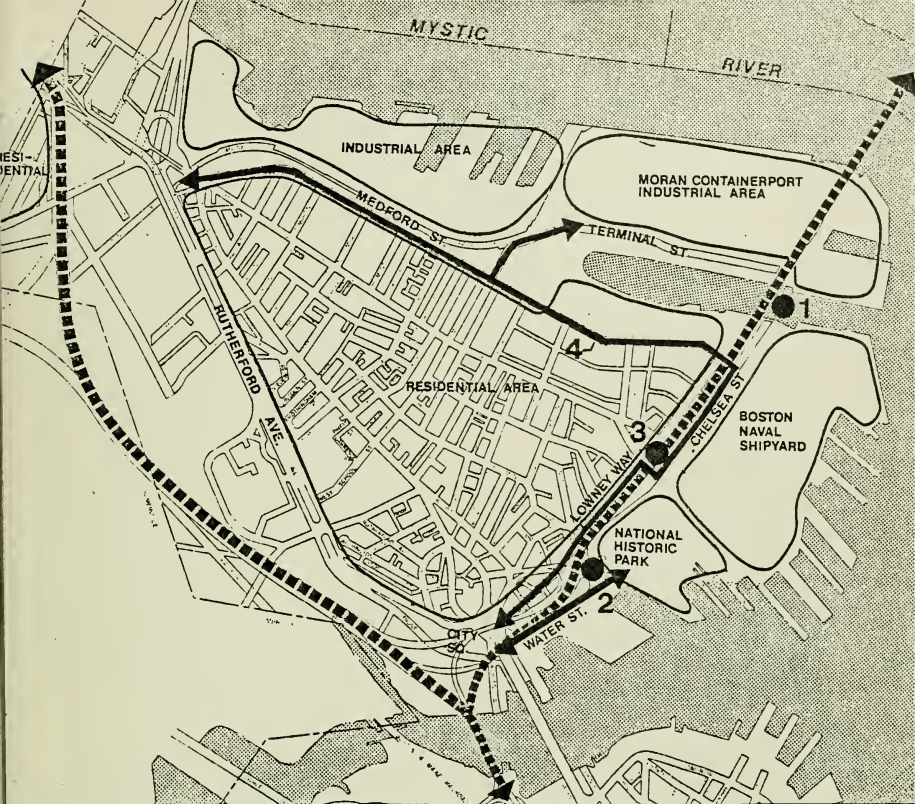
D. Central Artery

Certain alternatives outlined in the feasibility study for depression of the Central Artery would negate and render impossible the Chelsea-Water Street Connection. However, as the practicality of the Central Artery depression itself is still very much in question and as this represents a very long-range transportation planning aim, its impact potential on the presently contemplated improvements will necessarily be limited. The Chelsea-Water Street Connection and Little Mystic Bridge proposals are much more modest (local) in scope and represent an immediate response to existing Charlestown transportation problems and community demands.

Land Use and Related Plans

Charlestown is mainly a residential area, with a significant amount of industrial land around the periphery of the town. The corridor for proposed transportation improvements (see Figure 1) runs between the Tobin Bridge (east of the residential areas along Lowney Way, Bunker Hill Street, and Medford Street), and the former Boston Naval Shipyard and Hoosac Pier Industrial area.

The residential neighborhood along the corridor consists of private three to six-story brick row houses and two subsidized housing projects. One, Bunker Hill Housing, is three-story brick apartments, and the other, Charles Newtown Housing is two and three-story brick, concrete and wood apartments. There are a few local shops along Bunker Hill Street and Medford Street, and two schools in the immediate area. Some houses on the side streets to Lowney Way are currently undergoing renovation and upgrading, and MassPort is planning to improve the small park it owns on Lowney Way.



1. A new bridge across the Little Mystic Channel.
2. Connection of Chelsea Street and Water Street.
3. Relocation of the north bound Tobin Bridge off ramp
4. Close Medford Street and Lowney Way to trucks.

Major industries on the northern side of Medford Street, west of Terminal Street, are sugar refining and warehousing. Terminal Street provides access for the Moran Container Terminal, U.S. Gypsum, and Schiavone's scrap operations, all on the peninsula north of the Little Mystic Channel. Extending into the harbor to the east of Tobin Bridge are the Boston Naval Shipyard, now decommissioned, the new Boston Naval Shipyard, U.S.S. Constitution National Historic Site, and Hoosac Pier.

A. Charlestown Urban Renewal Plan

The Charlestown Urban Renewal Plan was accepted by HUD in 1965 and most of its active projects are complete: a developer has been selected for the Austin Street shopping center, a new firehouse has been built, over 500 new housing units have been constructed, and Bunker Hill Community College is in operation. Several parcels are committed to housing and mixed commercial/housing uses and await circumstances beyond BRA control (mortgages, MBTA elevated demolition) for development to proceed. A number of parcels along Chelsea Street, near City Square, are under development pressure, but uncertainty about future road alignments keeps them vacant.

B. Hoosac Pier

MassPort has developed the area between the railroad tracks and Water Street in front (to the west) of the Hoosac Pier warehouse building for commercial recreation use. The new building (the Bunker Hill Pavillion) houses a diorama of the revolutionary battle of Bunker Hill. Approximately 100 parking spaces for this activity are provided on site, and about 350 spaces exist under the Tobin Bridge. There also has been discussion of a fast food restaurant. In addition, MassPort is purchasing a Dutch Water Bus which would follow the BRA proposed harbor water route. One stop would be just south of the U.S.S. Constitution berth.

The owners of Grand Rapids Warehouse located immediately north of the

City Square end of the Charlestown Bridge have a consultant investigating park-related commercial uses for that site.

C. Boston Naval Shipyard/U.S.S. Constitution National Historic Site

Twenty-three acres of the former Boston Naval Shipyard have recently been designated part of the Boston National Historical Park. The Park will have a number of sites including several downtown, in the North End, and Bunker Hill and the shipyard in Charlestown. The main attraction at the Navy Yard site will be the frigate U.S.S. Constitution.

The Park is expected to generate as many as 1,500,000 visitors per year by 1978; approximately 700,000 people now visit the U.S.S. Constitution each year. Park plans do not call for on-site visitor parking, although bus unloading areas will be provided. There will be no admission charge to the Park, but it is not intended to serve as a neighborhood recreation area.

D. Moran Terminal Container Facility

MassPort plans to enlarge the 22-acre Moran Terminal Container Facility by approximately 12 acres. No additional crane capacity and only some additional storage is anticipated: therefore, the new space will be mostly for yard use. The additional space will permit an expansion of capacity from the current 60,000 TEU's (twenty-foot equivalent units) to 95,000 TEU's.

E. New High School

A new high school and athletic facility will be built at the corner of Terminal and Medford Streets. The athletic facility, currently under construction, will be on the north side of Medford Street, east of the intersection with Terminal Street. The high school itself will be on

the hill on the south side of Medford Street, east of Mystic Street.

F. Boston Naval Shipyard Land

The entire Boston Naval Shipyard, Charlestown and South Boston sites, was decommissioned in 1974. Twenty-three acres of the Charlestown land will be used for the National Historical Park, leaving approximately 60 acres available for development. The City of Boston has investigated a number of possible uses for the land, including housing, institutional, commercial, and industrial activities.

In the Land Use and Transportation Study, Boston Naval Shipyard, three combinations of uses were explored: A. Retail and residential, industry; B. Institutional (college and museums) with industry, luxury housing, hotel, and retail uses; and C. Institutional with a hotel-convention center, retail, and luxury housing. In addition, the BRA has proposed locating the John F. Kennedy Museum on the site in combination with housing, hotel, and retail use.

The development of the northern portion of the Yard is limited by the proposed elimination of the traditional Gate 1 roadway access through the National Park site. The proposed Chelsea-Water Connection in combination with general City Square improvements will render the site more accessible and suitable for development.

Description of Major Projects Elements

The present project is intended to achieve specific local improvements including the removal of trucks and extraneous through-traffic from Lowney Way and East Medford Street and the provision of improved access to Moran Terminal, the Navy Yard and the National Park. In addition, the Chelsea-Water Street Connection will lift the burden of Navy Yard access from a route through the center of the National Park.

One of the purposes of the DEIS is to investigate the range of logical alternatives which appear to be potential solutions to the access problems. The major transportation planning elements under study are the following:

1. A No-Build planning option which in addition to a status quo situation gives consideration to various traffic management and enforcement procedures.
2. The Chelsea-Water Street Connector including at-surface and below-grade tunnel options. The tunnel option involves two sub-options including a) the Chelsea-Water Street alignment close to the Tobin Bridge and b) a possible tunnel under the National Park site.
3. The relocation of the existing City Square off-ramp at Water Street is a possibility with any connection between Chelsea and Water Streets. Design investigations will attempt to avoid the relocation because of the expense involved, but where necessary, to provide space and better linkage with a connected Chelsea-Water, moving the ramp will be thoroughly investigated.
4. Two possible alignments for a Little Mystic Channel Bridge will be examined: straight using the existing supports if possible and curved. Each alternative which involves this bridge necessarily includes the choice between the two alignments. In addition, the geometric constraints for a possible rail facility on the bridge will be identified by the engineering sub-consultant, Edwards and Kelcey.

The above project elements can be combined in a number of different ways to produce at least 40 alternatives. Using engineering logic and with guidance from the several study participants, the state, and the Charlestown community itself, the number of alternatives was reduced to a more workable total of ten. These ten alternatives, representing various combinations of the study elements, were selected for analysis. A brief verbal description of

each alternative and the findings from initial evaluation are described below. First however, the criteria used to select and evaluate the effectiveness of each alternative are discussed.

Criteria for Selection of Study Alternatives

In order to narrow down the range of possible design alternatives which can be addressed and fully evaluated in the DEIS report, criteria were developed with the assistance of the Charlestown community for the purpose of selecting prudent study alternatives. The selection criteria agreed upon included:

1. Minimize Trucks on Local Streets - reduce noise and increase safety
2. Improve Access to Moran Containerport Industrial Area - northern sector of Navy Yard, and National Historic Park
3. Observe National Park Objectives - protect historic resources and park environment
4. Cost Feasibility
5. No Residential Takings
6. Other Concerns of Charlestown Residents

This set of criteria also performed an evaluative function in that the ten most plausible alternatives selected for analysis could be compared on the basis of criteria achievement or satisfaction. The results of this evaluation of plausible study alternatives is summarized in Table 1 and discussed in the following report subsection. This evaluation permitted a further narrowing of study alternatives to those combinations most suited to study refinement and detailed analysis. During Phase II of the DEIS, evaluation criteria will be applied to the selected study alternatives to permit comparisons on the basis of technical merits and level of goal achievement

Evaluation of Alternatives

1. No-Build (status quo)

A No-Build alternative is required to be carried forward as part of the EIS process since it can serve as a viable option and provide a means of comparing other possible alternative solutions.

Under a status quo situation, street access to Moran Terminal and other industrial areas will remain essentially unchanged. Instead of removing trucks from Lowney Way and East Medford Street, the tendency towards continuing use of the local street network will persist.

The need for improved access to the National Park and the Navy Yard (consistent with anticipated land use development trends) will not be solved, thereby resulting in further traffic congestion in the City Square area and adjacent local streets. Safe pedestrian linkages between the Charlestown community and the Park will become even more difficult to establish because of increased traffic along Lowney Way. Although historic structures will remain untouched, they could be impacted by the provision of traffic access through the Park to the northern part of the Navy Yard.

While certainly an option, this alternative does not provide a solution to the problem of truck traffic on local Charlestown streets. A No-Build situation is presently incompatible with expressed community goals and does not meet the objectives of this study which are to minimize trucks on Lowney Way and East Medford Streets and to provide improved access to Moran Container Terminal and the Navy Yard.

2. No-Build - Close East Medford Street to Trucks

This alternative is a variation of scheme #1 above. It has been suggested by the community as an intermediate interim solution to heavy trucking activities on the eastern section of Medford Street between Terminal and Chelsea Streets. As proposed, all trucks having origins or destinations in the northern industrial sectors of Charlestown would be routed around the periphery of the community and

in through Sullivan Square to West Medford Street.

This particular alternative can accomplish at best only partial satisfaction of project goals. While the suggested routing arrangement may reduce truck traffic on East Medford Street, it does not make provision for removing non-local automobile trips. If the route through Sullivan Square results in added travel time delays it is reasonable to assume that truckers will attempt to utilize the local street network in seeking access to Moran and other industrial sites. Thus one of the difficulties with this scheme is that it depends heavily on traffic management and enforcement procedures for its effectiveness. Another problem is that the Sullivan Square route will not provide for improved access to the Navy Yard and the National Park. Traffic destined for the northern sector of the Navy Yard will continue to use Lowney Way and/or access through the National Park. Both approach options are incompatible with stated project goals.

Alternative 2 does not solve the local trucking problem and related land use access needs of the Charlestown area. Because it does not meet these permanent long-term study objectives, Alternative 2 has been eliminated from further analysis. However, the traffic impact of routing all trucks through Sullivan Square to West Medford Street to Moran Terminal will be described during the course of the present study.

3. No-Build - Close Lowney Way to Trucks

By prohibiting truck traffic on Lowney Way the demand for access through the Park to serve the northern sector of the Navy Yard will increase. Conversely, the lack of better access to the northern sector will greatly restrain development.

The closing of Lowney Way to trucks would not only be difficult to achieve in practice but it would be confusing without the closing of Medford Street. Access to Moran Terminal and the Navy Yard would be circuitous and could result in truck traffic on other local streets. Besides enforcement difficulties, deficiencies

in traffic circulation and the potentially severe impact on the National Park make Alternative 3 unacceptable as a study alternative and, therefore, it will not be studied further.

4. No-Build - Close Both East Medford and Lowney Way to Trucks

Combining the features of Alternatives 2 and 3, Alternative 4 would require that trucks follow a circuitous route around Charlestown and pass through Sullivan Square to West Medford Street to reach Moran Terminal. Access to the northern sector of the Navy Yard would be difficult and would require access through the Park from City Square.

As with the other No-Build options, Alternative 4 would prove difficult to implement and enforce. Disruption of established traffic patterns, resulting increases in truck traffic through City Square, and inadequate access to the Navy Yard are the principal disadvantages. It has been determined that Alternative 4 would provide only an interim solution to local trucking ills and would not adequately deal with the larger problem of improved access and development in the Charlestown area. Because of this and the potentially adverse effects resulting from trucks and other vehicles passing directly through the National Park site, this alternative has been removed from further study consideration.

5. Two-Way Connector Without Bridge

Preliminary engineering investigations indicate that a two-way at grade Chelsea-Water Street Connection between the Tobin Bridge and the Commandant's House is feasible. This connection would reduce traffic on Lowney Way and improve access to the northern sector of the Navy Yard and the National Park.

By providing for the street connection without the new bridge, however, the risk of segmental planning is incurred. Moreover, this alternative fails to meet two basic project objectives: the removal

of trucks from East Medford Street and the provision of improved access to Moran Terminal. Without the bridge, truck traffic on east Medford Street will be likely to increase because of Shipyard development and expansion at Moran. Because Alternative 5 does not resolve the above access problems and study objectives, it has been dropped from further analysis.

6. Two-Way Connector With Bridge

Like scheme 5, Alternative 6 reduces traffic on Lowney Way and provides for improved access to the northern sector of the Navy Yard through Gate 5. Park access would also be enhanced since this connection makes existing entry points at Gates 4 and 5 more accessible.

The Chelsea-Water Street Connection will require relocation of a section of the historic Navy Yard wall. However, the Commandant's House will remain in place; some impact could be expected chiefly during the construction phase. No residential takings will be incurred; one small business relocation will be necessary. By removing traffic from Lowney Way, pedestrian linkages between the community and the National Park site can be improved. Appropriate traffic engineering and design controls will be employed to insure pedestrian safety and crossings of the Chelsea-Water Street Connection.

The principal advantage of Alternative 6 over scheme 5 is that it includes a bridge across Little Mystic Channel which, in combination with the Chelsea-Water Street Connection, will make access to Moran Terminal more direct and remove industrial traffic particularly trucks, from East Medford Street.

Because of its high level of goal achievement and favorable community support, this alternative will be pursued to the detail design phase.

7. Short Tunnel Without Bridge

Basically, Alternative 7 represents a design option to the Chelsea-Water Street at a grade connection.

Alternative 7 would reduce truck traffic on Lowney Way and improve access to the Navy Yard. While the design favors pedestrian circulation, access to the Park may be disturbed somewhat by the proximity of the tunnel entrance to existing Park entry points at Gates 1 and 2.

While the tunnel has the advantage of minimizing long-term disturbance of the historic Park resources, significant impacts could be expected during the construction phase. Like Alternative 6, a section of the historic Navy Yard wall will have to be relocated.

There has been no strong expression of community support for this alternative. The disadvantages are many including its cost (estimated in excess of \$5 million) and the difficulty of construction due to the presence of Tobin Bridge footings. Moreover, the tunnel alone will not remove trucks from East Medford Street and only partially improve access to Moran Terminal. Because of these disadvantages, the tunnel without the bridge is not considered worthwhile and has been ruled out from the list of study alternatives.

8. Short Tunnel With Bridge

Unlike Alternative 7, the combination of the tunnel with the bridge will effectively reduce truck traffic on both Lowney Way and East Medford Street. Access to the Navy Yard and Moran will also be improved. Possible conflict between tunnel access and Park entry points may present a problem. The historic Navy Yard wall will have to be relocated with some impact on the Commandant's House during construction. The chief drawback of this alternative is its cost (tunnel construction alone estimated in excess of \$5 million). Design difficulties could also present a problem should the existing City Square

off-ramp at Water Street be relocated further north onto Chelsea Street near the tunnel exit.

High cost and construction difficulties would seem to render this alternative impractical and difficult of implementation. However, because Alternative 8 does satisfy all project goals, it will be subject to further study as to its feasibility of implementation.

9. Bridge Only

Some relief in the traffic situation on East Medford Street could result from the presence of a bridge facility, including better access to the Navy Yard and Moran Terminal from Sullivan Square. While the National Park would not be impacted directly, pedestrian access would not be improved and traffic congestion could be expected on Lowney Way during peak hours and in proximity to Park entry points.

Without the Chelsea-Water Connection, traffic increases on local Charlestown streets would occur as a function of Navy Yard reuse activities. Trucks and extraneous through-traffic will continue to impact Lowney Way and its bordering residential areas. For these reasons, the bridge only alternative is not regarded as a viable study option and will not be studied further.

10. Long Tunnel Under Park With or Without Bridge

This particular alternative would improve access to the Navy Yard and Moran Terminal and reduce truck traffic on Lowney Way. With a bridge facility, truck traffic on East Medford Street would also be reduced.

While this alternative could meet project goals, it is deemed to be infeasible because of 1) high cost, 2) the difficulties of construction, and 3) long implementation time. A dense system of underground utilities and many deep building foundations make the tunnel connection to Chelsea Street an expensive design and construction problem. The

Alternatives & Recommendations	Criteria						
	Minimize Trucks on Residential Streets	Improve Access to: Moran Nat'l Park, Navy Yard	Nat'l Park Objectives: Historic Resources, Park Envi- ronment	Construction Cost Feasibility	No Residen- tial Takings	Compatibil- ity with Community Goals and Interests	Remarks
No build- status quo Further Study	Truck traffic will increase because of Moran, Navy Yard, Park	No Improvement	Historic resources not changed Congestion at Park entrance	No Cost	None	Would not remove trucks	Entry to Park and Navy Yard not solved
No build- close Medford to trucks Limited study	Would reduce trucks on E. Medford Might on Lowney	Cause cir- cuitous access to all	Historic resources not changed Trucks thru Park	Small cost depending on implementa- tion	None	Depends on effective- ness	Difficult to enforce, trucks on other streets sub. Lowney for Park truck route
No build- close Lowney to trucks drop	Would reduce trucks on Lowney, might on E. Medford	Cause cir- cuitous access to Moran & Navy Yard	Historic re- sources not changed - Trucks thru Park	Small cost depending on implementa- tion	None	Depends on effective- ness	Difficult to enforce, trucks on other streets
No build- close Medford & Lowney to trucks drop	Would reduce trucks on E. Medford & Lowney	Access to Navy Yard only thru Park, cir- cuitous access to Moran & Park	Disruption from trucks	Small cost depending on implementa- tion	None	Depends on effective- ness	Difficult to enforce, trucks on other streets
Two-way con- necter with no bridge, drop	Would reduce trucks on Lowney, may increase on E. Medford	Would im- prove ac- cess to Navy Yard, give opp. to im- prove Park access	Move histor- ic wall, indirect impact on Commandant's house	Probably feasible	None	May impede ped. access to Park	Ped. connec- tions can be designed
Two-way con- necter with bridge, fur- ther study	Would reduce trucks on Lowney and probably E. Medford	Improves access to Moran & Yard allows for improvement to Park	Move histor- ic wall, indirect im- pact on Commandant's house	Probably feasible	None	May impede ped. access to Park	Recommended for design development
Short tunnel with no bridge, drop	Would reduce trucks on Lowney, may increase on E. Medford	Would im- prove access to Navy Yard and Moran; entry prob. for Park	Relocate historic wall, impact on Comm- andant's house chiefly dur- ing construc- tion	1971-84 mil- lion, current =\$5million probably not feasible	None	May improve ped. access to Park	
Short tunnel with bridge, further study	Would reduce trucks on Lowney and E. Medford	Would im- prove access to Navy Yard and Moran entry prob- lem for Park	Relocate historic wall, impact on Comm- andant's house chiefly dur- ing construc- tion	Above costs plus bridge probably not feasible	None	May improve ped. access to Park	Very expen- sive
Bridge only, drop	Would reduce trucks to Navy Yard on E. Medford & Lowney, would remove trucks from Park	Would pro- vide access to Yard for trucks	Historic resources not changed	Probably feasible	None	Would not significan- tly reduce truck traffic	Does not make sense to build without connection
Long tunnel under Park, with or with- out bridge, drop	Would reduce trucks on Lowney	Would pro- vide access to Yard entry prob. for Park	Historic re- sources not changed, dis- ruption dur- ing con- struction	Probably not feasible	None		Utilities are very dense, connection to Chelsea St. is difficult

disruption caused to the Park and Navy Yard during construction would be long and substantial. Because project cost and the time of implementation of recommended improvements are considered to be important project constraints, this alternative does not represent a viable planning option and it has been dropped from further evaluation

Selection of Alternatives for Detailed Analysis

Based on the foregoing discussion and analysis, the alternatives recommended for further detailed study and evaluation are:

Alter-
native
No.

Description

Remarks

1	No-Build - status quo	EIS requirements
6	Two-Way Connector + Bridge	Recommended for design development
8	Short Tunnel + Bridge	Recommended for further study; possible design development

Detailed analysis of the three selected study alternatives will be carried forward under Phase II of this study. Pursuant to state and federal EIS requirements, the effects of the proposed transportation project will be assessed in terms of the consequences on the physical and human environment. Documentation of the probable environmental consequences will be submitted in text and/or graphic form and include the following items:

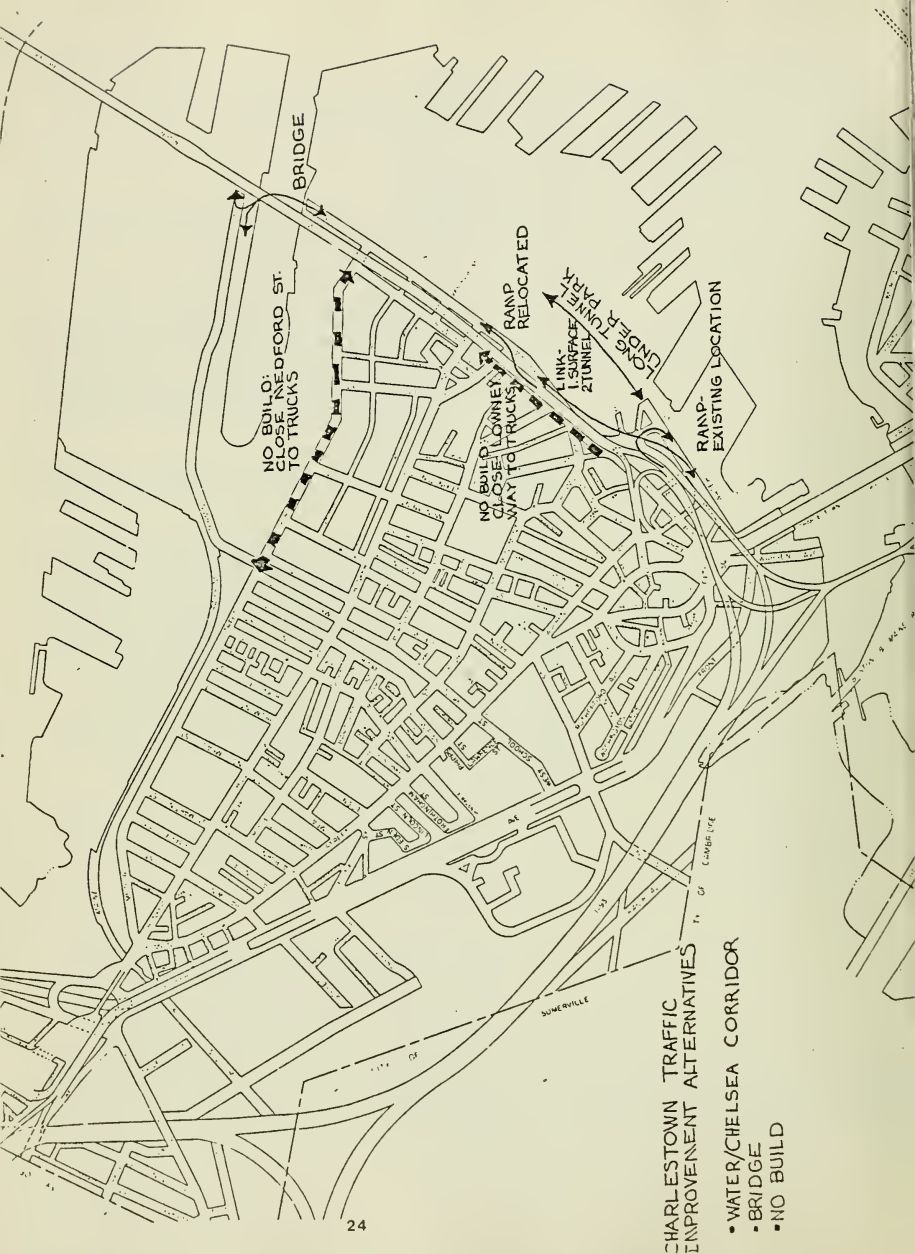
1. All factors affecting cost: soil condition, utilities, etc.
2. Economic impacts
3. Social impacts
4. Land use considerations - mass transit, parking, schools, recreation, churches, shopping centers, urban renewal, 4(f)'s, 106, etc.

5. Inventory of property taken, property lines, value, number of employees, relocation required
6. Air and noise pollution levels; water quality
7. Other EIS requirements as contained in FHWA's PPM 7-7-2, PPM 90-2 and appropriate state documents.
8. It will be demonstrated that the selected study alternatives have been thoroughly investigated prior to any subsequent elimination. The consultant will evaluate these alternatives adequately and submit the necessary supporting data to substantiate his conclusions.

Constraints on the Analysis of Selected Study Alternatives

Various combinations of transportation elements involving the Chelsea-Water Connector, the bridge and ramp facility are feasible of development within the framework of the three selected study alternatives. Based on analysis and discussions with the study participants, the community and state, certain constraints have been identified which will now eliminate some combinations of these elements and assist in further narrowing down the range of acceptable study alternatives. The criteria constraints which have been agreed upon include the following:

1. The existing Chelsea Street on-ramp will remain open to provide Charlestown residents with access to the Tobin Bridge and Central Artery northbound.
2. Relocation of the existing City Square off-ramp at Water Street to a point further north involving a ramp down from the Tobin Bridge has been terminated from further study consideration. A consensus was reached among the engineering consultant, the city and state that relocation of the off-ramp does not represent an acceptable design option at this time for the following reasons:



CHARLESTOWN TRAFFIC IMPROVEMENT ALTERNATIVES

- WATER/CHELSEA CORRIDOR
- BRIDGE
- NO BUILD

- a) An off-ramp at this location would create an unsafe traffic condition involving a potentially dangerous traffic weave with short cross-over distance (about 500 feet) between the left-handed Tobin Bridge on-ramp and the relocated City Square off-ramp. The space requirements necessary to safely handle vehicular acceleration, the proper merging and crossing of three lanes of Central Artery traffic, and exit ramp deceleration needs far exceed the amount of weaving distance provided under this design scheme. Moreover, the continuing upgrade of the Central Artery/Tobin Bridge approach in conjunction with the downhill grade requirements of the proposed Chelsea-Water Connector render a more northerly ramp location impractical. A long descent ramp with larger land takings in the National Park area and a potentially greater traffic impact on the local Charlestown street system, including a circuitous route back to City Square, make such a ramp location an unattractive design option.
- b) Uncertainties over the future Central Artery depression and design needs make the relocation of the existing ramp and disturbance of existing Charlestown traffic patterns and unadvisable option.
- c) Moving the off-ramp is considered less desirable than modifying the existing ramp because of the greater expense involved. Moreover, the proposed transportation improvements are modest in

scope and are intended to resolve certain local transportation problems.

3. Two possible alignments for a Little Mystic Channel Bridge and possible rail facilities have been investigated straight using the existing supports, and curved. The curved alignment makes the possibility of a separate rail connection across the channel feasible, should it later prove desirable, and has been selected for detailed development. The straight alignment has been eliminated because of severe design constraints. The latter would involve passing the new bridge access around Tobin Bridge support columns to make a connection with Terminal Street. Existing freight handling operations at Mystic Pier would be disrupted and an existing Massport building would have to be relocated. A straight-ahead rail alignment has also been ruled out. Despite its shorter channel span, the straight alignment would have a greater impact on the community, the Navy Yard and Mystic Pier because of its longer approaches and associated grade requirements.

In summary, the above constraints will guide the furtherance of the DEIS process throughout Phase II - Development and Evaluation of Selected Study Alternatives. No decision will be reached on final alternative selection until after the public hearing and completion of the EIS process. MDPW procedures require a public hearing to be held 45 days after formal circulation of the Draft EIS Report. MDPW, in consultation with FHWA, will evaluate comments received at the public hearing, and comments received from circulation of the Draft EIS, in the preparation of a Final EIS, as may be necessary. The Final EIS will be prepared by BRA and MPA to be circulated in accordance with MDPW and FHWA procedures.

APPENDIX B

Design Criteria

Little Mystic Channel Crossing

Three possible alignments have been investigated for the bridge connecting Chelsea and Terminal Streets across the Little Mystic Channel, see fig. B.1.

CRITERIA

Tobin Bridge Piers: The Tobin Bridge's 350 foot truss approach span is carried by piers on either side of the Channel, see fig. B.1.

Ship Clearance: The Coast Guard has tentatively indicated they would require a 75 foot wide boat channel with 10 foot under-clearance from any overhead structure at mean high water (elevation 10.23 Boston base). These requirements are subject to further hearing and decisions by the Coast Guard.

Cargo Shed: Massport has recently constructed a Cargo Shed east of the Tobin Bridge at the location shown on fig. B.1. It is necessary to allow room to the south of the structure for maneuvering trucks.

Railroad Tracks: A regularly used rail spur serving Pier #1 and U.S. Gypsum runs between Terminal Street and the Little Mystic Channel.

Future Rail Link: Future land uses in the northern Shipyard are uncertain, thus the need for future rail service is unknown. Northern railroad access to the Shipyard would enable the National Park Service to meet its stated objective of discontinuing rail service from the south through the National Historical Park. The northern Shipyard could be connected to the Terminal Street rail yards by a bridge across the Little Mystic Channel. Rail design criteria for horizontal curvature and vertical grades suggest that the most feasible alignment for a rail service from Terminal Street to the northern Shipyard is from the northwest to the southeast, see fig. B.1.

ALIGNMENT A

One of the first schemes studied was a straight continuation of Chelsea Street as it was before the Tobin Bridge was built, see sketches A and B. With the required clearance over the channel the bridge profile must have at least 500 feet of descending length between center line of channel and meeting existing Terminal Street.

A straight alignment would conflict with the operations of an existing Massport cargo shed in Moran Terminal.

Since a majority of truck traffic crossing north over the channel is destined for the scales at the west end of Terminal Street, the roadway must pro-

vide for a turn to the west (left). The roadway must also pass under the Tobin Bridge and between its supporting piers. These piers are approximately 110 feet apart and would require that the roadway be split to provide adequate horizontal curvature for truck traffic, see sketches A and B.

This alignment would have a heavy down grade (4% - 5%) and a radius of curvature as low as 130 feet. This scheme would be in embankment on the Terminal Street side and would also cut the existing rail connections to Mystic Pier No. 1.

It would also preclude a future rail link across the Channel to the northern Shipyard.

ALIGNMENT B

A straight bridge on an alignment perpendicular to the Channel has been studied. With the required 10 ft. clearance over the Channel, this version of a straight bridge would have a vertical grade of 3%. It would pass between the Tobin Bridge supports as it crosses the Channel.

Truck and rail movements and storage requirements for the Pier operations can be accommodated with this straight bridge. They would be less direct and at a lower level of service than Alignment C. Two of the three rail tracks to Mystic Pier 1 would be truncated, leaving one track to service the Pier.

The straight bridge perpendicular to the Channel would preclude a future rail link to the northern Shipyard. However, it would satisfy the remaining design criteria and has been studied as one of the possible bridges for the build alternatives.

ALIGNMENT C

The curved crossing of the Channel would connect Chelsea Street on the southeast to Terminal Street on the northwest. It would have a maximum vertical grade of 2%. The curved alignment would leave open the possibility of a future rail link to the northern Shipyard and would satisfy the remaining design criteria. It has been studied as a possible Channel crossing for the build alternatives.

Because current velocities in the Channel are low (see Appendix G, p.218, Table IX. D-1 for velocities), it will be possible to design the bridge piers perpendicular to the bridge and not necessarily perpendicular to channel flow. This will simplify design of the curved bridge.

CAPACITY AND COSTS

To establish maximum costs and impacts, a four-lane bridge has been studied. Anticipated traffic volumes and the operational requirements of Moran Terminal suggest that a two-lane bridge built to MDPW standards would be sufficient; costs would be proportionately lower. A four-lane curved bridge (alignment C) is estimated to cost approximately \$2.60 million; the two-lane curved crossing would cost approximately \$2.22 million. A four-lane straight bridge (alignment B) is estimated to cost approximately \$1.62 million; the two-lane straight bridge would cost approximately \$1.40 million. See Appendix C for details of cost estimates.

Bridge capacity and characteristics will be established during final design.

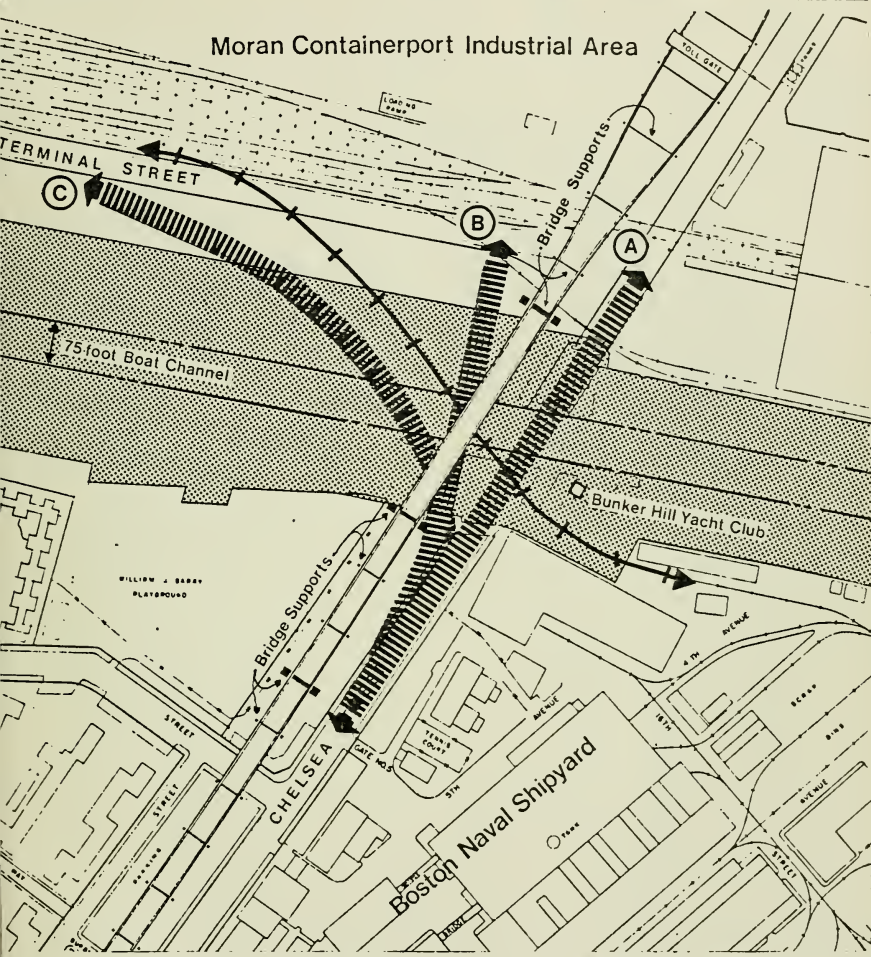
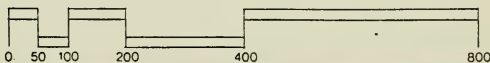
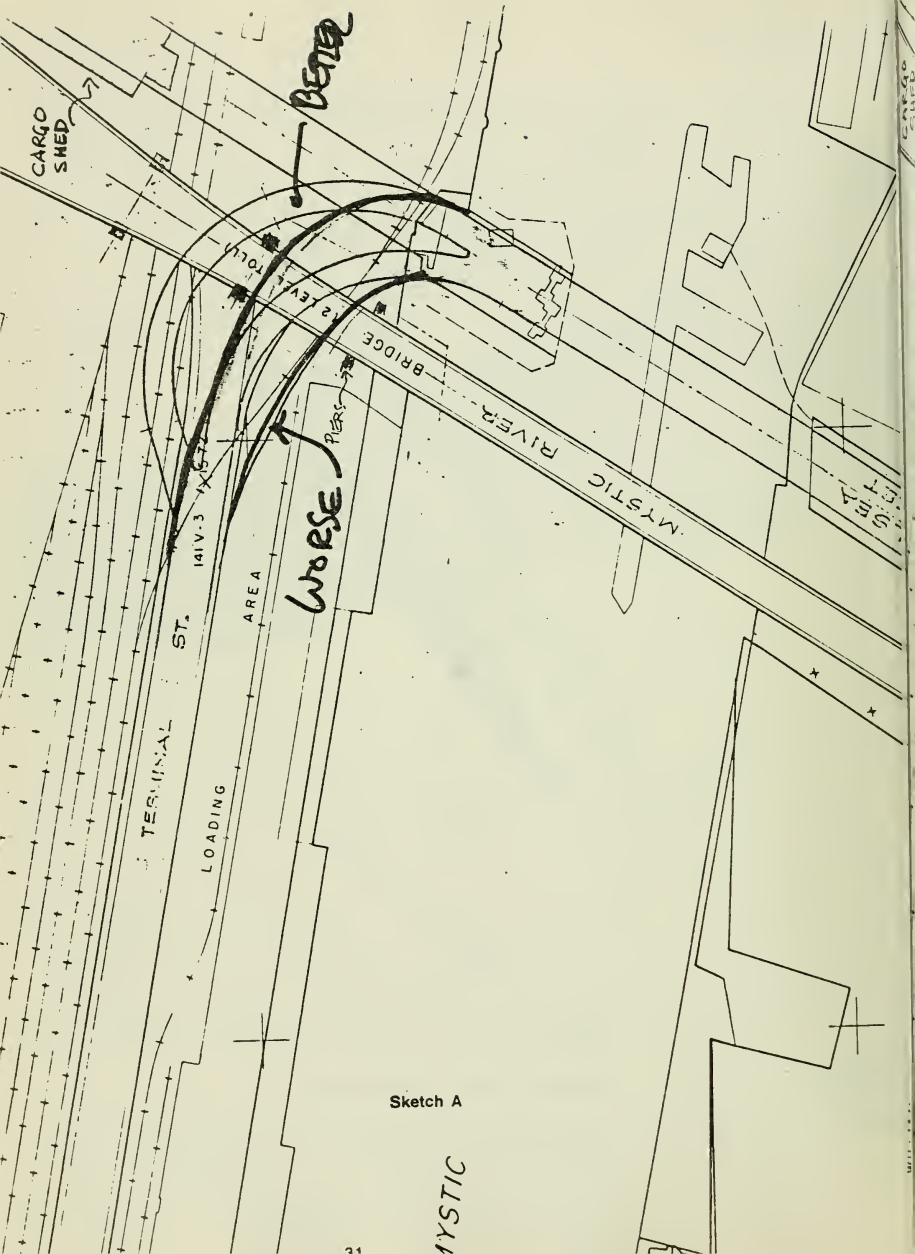


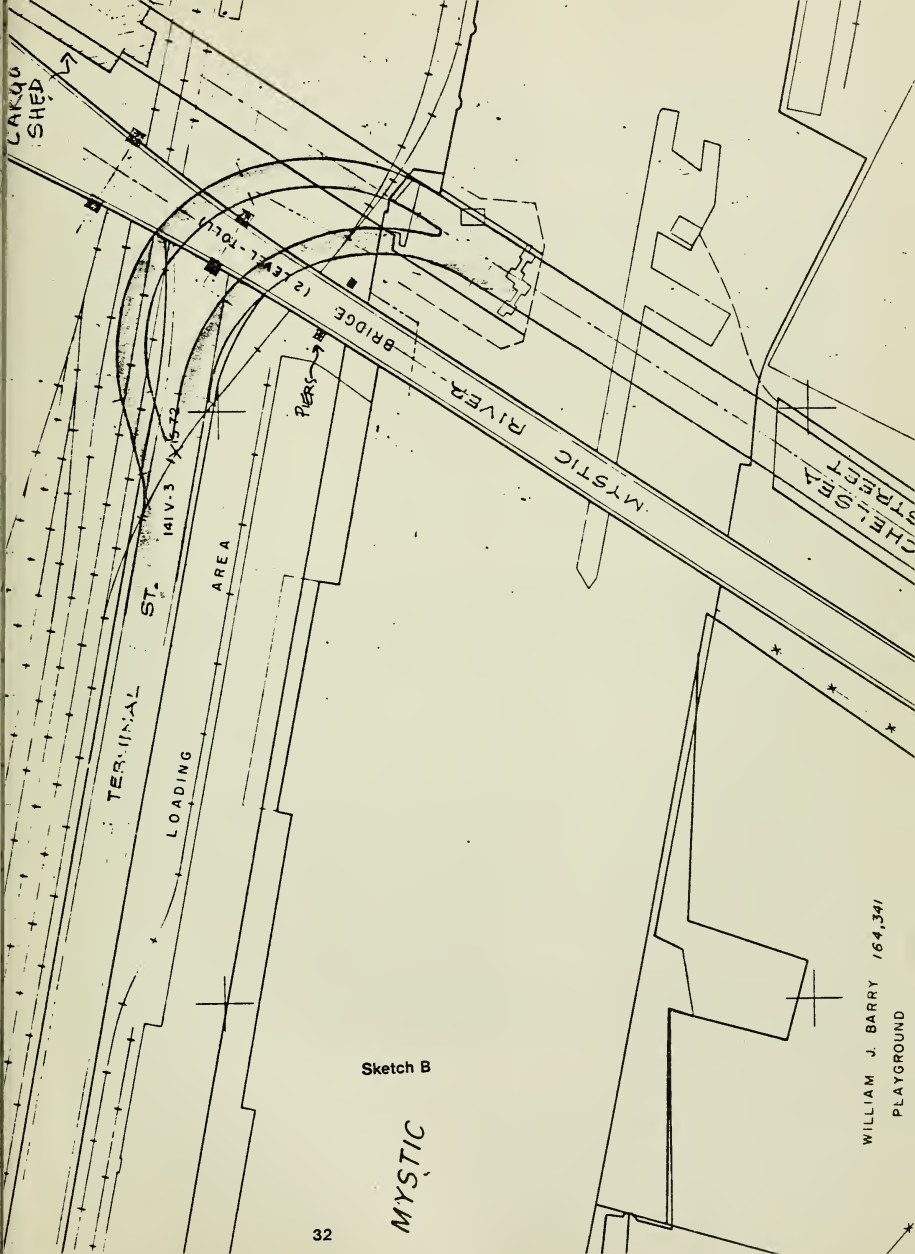
Figure B1

Bridge Design Constraints

Chelsea-Water Streets Connector - Little Mystic Channel Crossing
Draft Negative Declaration







ENGINEERING
FACTORS

Design Criteria

Design criteria used for the geometrics of the Chelsea/Water Street Connector are in accordance with the minimum standards of the American Association of State Highway and Transportation officials (AASHTO) for a design speed of 30 MPH. The following is a summary of the more important values used:

Design speed:	30 MPH
Maximum gradient:	6 percent
Minimum vertical clearance:	14' - 16"
Minimum stopping sight distance:	200 feet
Roadway width	ramp: 22' minimum
	connector: 46' (4 lanes)
Sidewalks:	6' minimum

Choice of
Design
Concepts

Because of the large number of alternative concepts for the connector and ramp, the BRA, Mass Port and its consultants carried out an investigation in order to eliminate those concepts which were not feasible before embarking upon a Draft EIS. This work is detailed in the Phase I Report, Appendix A. These studies showed that the following concepts should be abandoned:

1. No build which relied upon management of traffic flow and elimination of trucks from Medford Street and Lowney Way. This strategy was rejected because of the difficulty of enforcement and the lack of alternate truck routes.
2. A long tunnel under the National Park from Water Street along 1st Avenue to connect with Chelsea Street. This was eliminated because of the enormous disruption to the Park during the long construction period, and the difficulties of

conflict with the underground utility system and with historically valued buildings in the non-park portions of the Shipyard.

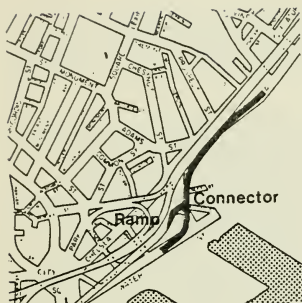
3. Ramp relocations to the north and south of the Chelsea Street on-ramp. The danger of a short weaving distance (Chelsea Street on-ramp) was felt to be great enough to eliminate any ramp "downstream" of the existing Chelsea Street on-ramp. In the same way, the weaving distance from the joining of I-93 and the Central Artery to the existing Water Street off-ramp is short enough to make any relocation of the ramp "upstream" of its current location appear to also be unsafe.
4. Straight bridge alignment A across the Little Mystic Channel. This straight alignment was determined to be unsuitable because of its steep vertical grade (4-5%) and the poor geometrics of the Terminal Street intersection.

There remained for design investigation an at-grade or below grade link between the Commandant's house and the Tobin Bridge, a new off-ramp leaving the Expressway at the existing location and a straight or curved bridge across the Little Mystic Channel.

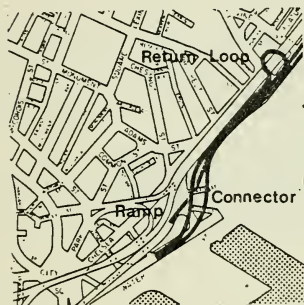
Design Alternatives

As various design options were developed, criteria were applied to select those suitable for detailed investigation and impact evaluation. These criteria included: minimization of takings from the National Park, rationalization of traffic patterns, maximization of safety, minimization of impact on community, and minimization of structures in order to reduce cost.

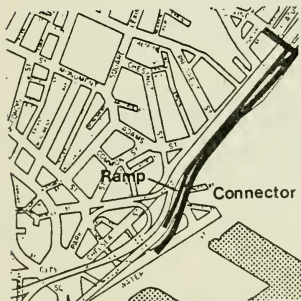
The following design alternatives were eliminated for the reasons outlined below, leaving for detailed consideration the alternatives described in Chapter IV, Sections A through J:



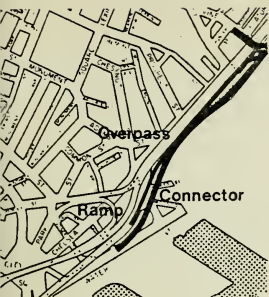
1. T Intersection. The off-ramp from the expressway would meet the at-grade link at a signalized intersection. The advantage of low cost and shorter construction period were outweighed by the disadvantages of inadequate stacking space to handle projected traffic and related substandard safety characteristics.



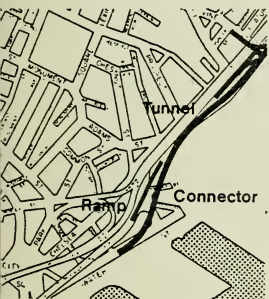
2. At-grade link, northbound off-ramp with southbound loop at Vine Street. The link roadways are separated, the southbound lanes passing over the expressway off-ramp. The ramp joins the northbound link only, and a large loop turnaround is provided between Bunker Hill Street and Vine Street. The ramp configuration was considered acceptable and is incorporated in Alternative 2. The loop was necessary only for trucks and the truck traffic was not felt to be sufficient to warrant construction of the additional roadway nor was it desirable to encourage truck drivers to make this movement. The loop also created both a complex traffic pattern and an impingement on a community area close to a school. The BHA property to be taken for the loop is possibly eligible for 4(f) protection.



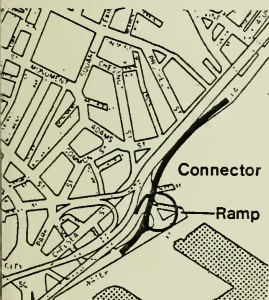
3. At-grade link, with expressway off-ramp parallel to Chelsea Street and joining at Vine Street. This scheme would have required the taking of the Commandant's House, and the Vine Street intersection would have been difficult.



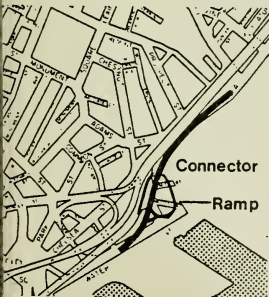
4. Same as 3. above with ramp passing over the connector behind the Commandant's House. Although saving the house, this scheme would have required a large amount of structure to carry the ramp over the link, and still would have the disadvantage of a difficult intersection at Vine Street. The structure behind the Commandant's House would be very destructive visually and acoustically to its environment.



5. Same as 4. above with the ramp passing under the connector behind the Commandant's House. This solution has the same problems as those above compounded by a difficult grade situation.



6. Circular loop ramp passing under link. This ramp solution has been used in Alternative 3 with the tunnel connection. The ramp has been made to pass over the portal of the tunnel so that the grades facilitate the slowing of vehicles as they exit.



7. Oblong loop ramp passing under link. The changing radius of the ramp was felt to be unsafe.

Alternatives Chosen
for Impact Analysis

The following design alternatives were chosen for impact analysis:

1. No-Build.
2. At-grade link with separated north and southbound lanes, bridge and approach off-ramp passing under southbound lanes and merging with northbound only; a bridge across Little Mystic Channel.
- 2A. Same as above but off-ramp has both north and southbound movement; a bridge across Little Mystic Channel.
3. Tunnel link with circular off-ramp providing north and southbound movements; a bridge across Little Mystic Channel.
4. At-grade link with at-grade intersection with off-ramp providing north and southbound movements; a bridge across Little Mystic Channel.

APPENDIX C

Construction Cost Data

These estimates are based on current costs. Right-of-way acquisition costs are not included. The costs for the improvements to Chelsea Street between the connector and the bridge are computed separately here, but are included in the total figure for each Alternative in Chapter V, Section B.

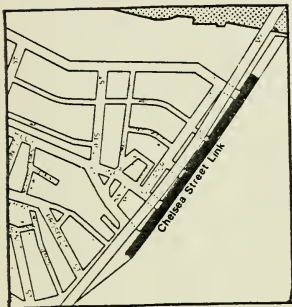
CHELSEA STREET LINK:

Utility
Relocation

Adjustment at manhole covers and catch basins.

Length

Approximately 1900 feet.



Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea Street Link From Connector to Bridge

(Applies to all alternatives)

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	KDB	Sheet 1 of 1
Checked by	MRW	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	3,500	C.Y.	EARTH EXCAVATION	1.75	6,125.00
	950	L.F.	TRACK EXCAVATION	7.50	7,125.00
	2,000	C.Y.	ORDINARY BORROW	3.00	6,000.00
	1,800	C.Y.	GRAVEL BORROW	3.50	6,300.00
	5,000	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	4,000.00
	600	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	4,800.00
	1,800	TON	CLASS I BIT. CONC. BASE COURSE-TYPE I-1	15.00	27,000.00
	5,000	LB.	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL	0.10	500.00
	700	TON	CLASS I BIT. CONC. PAVEMENT, TYPE I-1	15.00	10,500.00
	1,800	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	16,200.00
	150	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	1,800.00
	2,100	S.Y.	CONCRETE SIDEWALK-1 COURSE	10.00	21,000.00
	1	L.S.	LOAM AND SEEDING	2500.00	2,500.00
	1	L.S.	ROADWAY LIGHTING	65,000.	65,000.00
	1	L.S.	UTILITY RELOCATION AND DRAINAGE	25,000.	25,000.00
			TOTAL CONSTRUCTION COSTS		203,850.00
	1,000	HRS.	TRAFFIC POLICE	8.00	8,000.00
			SUBTOTAL		211,850.00
			10% ENGINEERING AND MISCELLANEOUS		21,150.00
			GRAND TOTAL		\$233,000.00

LITTLE MYSTIC BRIDGE:

Utility
Relocation

None required.

Construction
Sequence

Phase I

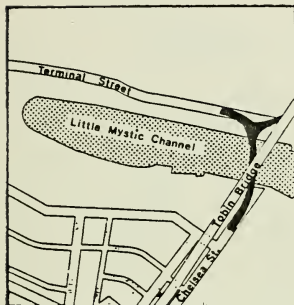
1. Construct bridge and approach roadways
Station 8 + 00 to Station 14 + 00.
2. Provide access on Chelsea Street to the
Bunker Hill Yacht Club for its members.
This access must remain open during the
entire construction period.

Phase II

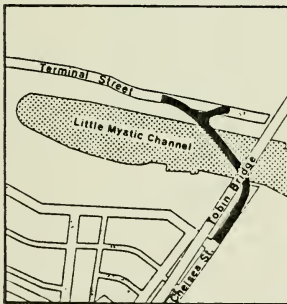
1. Construct temporary bypass on the north
side of Terminal Street.
2. Complete construction of Chelsea Street
from Station 0 + 00 to Station 8 + 00 on
the south side and on the north side from
Station 14 + 00 to Station 19 + 50 along
with the east ramp.
3. During the construction in the vicinity of
Chelsea and Medford Streets, the parking
area just east of the Mystic River Bridge
can be used as a temporary roadway.
4. Temporary, secure parking should be pro-
vided to the members of the Bunker Hill
Yacht Club either under the Mystic River
Bridge between Vine Street and Medford
Street or in the Shipyard.

Phase III

1. Open bridge and remove the temporary bypass
on Terminal Street.



Alignment B
Straight Bridge Element



Alignment C
Curved Bridge Element

Curved Bridge Element Summary Sheet

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by	DGV	Sheet 1 of 5
Checked by	ACC	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			BRIDGE ESTIMATE SUBTOTAL		1,912,452.50
	1	L.S.	HIGHWAY ESTIMATE	225,000.	225,000.00
	1	L.S.	ROADWAY LIGHTING	142,000.	142,000.00
	1	L.S.	UTILITY RELOCATION AND DRAINAGE	70,000.	70,000.00
			TOTAL CONSTRUCTION COST		2,349,452.50
	2,000	HRS.	TRAFFIC POLICE	8.00	16,000.00
			SUBTOTAL		2,365,452.50
			10% ENGINEERING AND MISCELLANEOUS		234,547.50
			GRAND TOTAL		\$ 2,600,000.00

NOTE

These costs are based on a 4-lane crossing. A
2-lane crossing would cost approximately \$2,220,000.

S Estimate

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Curved Bridge Element Bridge Costs

2.5

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic-Channel Crossing
Draft Negative Declaration

Computed by

DGV

Sheet

Checked by

ACC

2 of 5

Date OCTOBER 1975

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	1,500	C.Y.	BRIDGE EXCAVATION	7.50	11,250.00
	1,000	C.Y.	CHANNEL EXCAVATION	5.50	5,500.00
	650	C.Y.	GRAVEL BORROW	3.50	2,275.00
	195	TON	CLASS I DENSE BIT. CONC. TYPE ST	10.50	2,047.50
	195	TON	CLASS I DENSE PROTECTIVE (BOTTOM) COURSE FOR BRIDGES	28.00	5,460.00
	1,600	L.F.	GRANITE CURB TYPE VA-5-STRAIGHT	10.00	16,000.00
	2,000	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	280,000.00
	1,200	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	192,000.00
	500,000	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	200,000.00
	7,680	L.S.	SHEAR CONNECTORS	1.00	7,680.00
	9,630	L.F.	STEEL PILE HP 12 IN. 53 LB.	17.00	163,710.00
	8	EA.	TEST PILE	900.00	7,200.00
	3	EA.	PILE LOADING TEST	7000.00	21,000.00
	97,760	LB.	STEEL SHEETING	0.50	38,880.00
	1,250,000	LB.	STRUCTURAL STEEL-A588(CURVED)	0.75	937,500.00
	900	S.Y.	MEMBRANE WATERPROOFING	5.50	4,950.00
	500	S.Y.	BITUMINOUS DAMP-PROOFING	2.00	1,000.00
	1,600	L.F.	METAL BRIDGE RAILING(1-RAIL) OPTION	10.00	16,000.00
			BRIDGE ESTIMATE SUBTOTAL		1,912,452.50

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by	MRW	Sheet 3 of 5
Checked by	KDB	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	3,850	C.Y.	EARTH EXCAVATION	1.75	6,737.50
	1,600	C.Y.	ORDINARY BORROW	3.00	4,800.00
	2,200	C.Y.	GRAVEL BORROW	3.50	7,700.00
	5,000	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	4,000.00
	825	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	6,600.00
	2,500	TON	CLASS I BIT. CONC. BASE COURSE, TYPE I-1	15.00	37,500.00
	5,000	LB.	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL	0.10	500.00
	1,050	TON	CLASS I BIT. CONCRETE PAVEMENT, TYPE I-1	15.00	15,750.00
	2,100	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	18,900.00
	200	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	2,400.00
	1,150	S.Y.	CONCRETE SIDEWALK-1 COURSE	10.00	11,500.00
	580	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	81,200.00
	85	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	13,600.00
	31,350	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	12,540.00
	300	S.Y.	BITUMINOUS DAMP-PROOFING	2.00	600.00
			TOTAL		224,327.50
			SAY TOTAL HIGHWAY ESTIMATE		\$ 225,000.00

Estimate

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**Curved
Bridge Element
Utility Relocation &
Drainage**

Sheet
4 of 5

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by TRM

Checked by ACC

Date OCTOBER 1975

Sheet

4 of 5

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	7	EA.	TELEPHONE M.H. RESET (BY OTHERS)	--	--
	2	EA.	GAS GATES RESET (BY OTHERS)	--	--
	10	EA.	LIGHT POLES REMOVED (BY OTHERS)	--	--
	12	EA.	ELECTRIC M.H. RESET (BY OTHERS)	--	--
	7	EA.	CATCH BASIN ABANDONED	250.00	1,750.00
	15	EA.	MANHOLES RESET	200.00	3,000.00
	5	EA.	CATCH BASIN RESET	200.00	1,000.00
	17	EA.	CONSTRUCT CATCH BASIN	1000.00	17,000.00
	8	EA.	CONSTRUCT MANHOLE	1200.00	9,600.00
	510	L.F.	10" R.C.P.	30.00	15,300.00
	240	L.F.	15" R.C.P.	40.00	9,600.00
	50	L.F.	18" R.C.P.	45.00	2,250.00
	6	EA.	FIRE HYDRANT REMOVED AND RESET	600.00	3,600.00
	21	EA.	WATER GATE RESET	200.00	4,200.00
	1	L.S.	SPECIAL WATER MANHOLE	2000.00	2,000.00
	1	EA.	POLICE BOX REMOVED AND RESET	600.00	600.00
			TOTAL		69,900.00
			SAY TOTAL UTILITY RELOCATION AND DRAINAGE		\$ 70,000.00

**Curved
Bridge Element
Roadway Lighting**

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

**Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration**

Computed by	TRM	Sheet 5 of 5
Checked by	ACC	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	42	EA.	CONSTRUCT LIGHT POLES	2000.00	84,000.00
	42	EA.	PRECAST CONCRETE PULL BOX	300.00	12,600.00
	2	EA.	CONTROL BOX	4000.00	8,000.00
	3300	L.F.	2" CONDUIT	8.00	26,400.00
	8500	L.F.	#4 WIRE	1.00	8,500.00
	3500	L.F.	#10 WIRE	0.70	2,450.00
			TOTAL		141,950.00
			SAY TOTAL ROADWAY LIGHTING		\$ 142,000.00

Straight Bridge Element Summary Sheet

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by	ACC	Sheet 1 of 5
Checked by	DWC	
Date	JUNE 1977	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			BRIDGE ESTIMATE SUBTOTAL		1,149,000
	100,000	1 L.S.	HIGHWAY ESTIMATE	100,000	100,000
	140,000	1 L.S.	ROADWAY LIGHTING	142,000	142,000
	70,000	1 L.S.	UTILITY RELOCATION AND DRAINAGE	70,000	70,000
			TOTAL CONSTRUCTION COST		1,461,000
	2,000	HRS	TRAFFIC POLICE	8.00	16,000
			SUBTOTAL		1,477,000
			10% ENGINEERING AND MISCELLANEOUS		143,000
			GRAND TOTAL		1,620,000

NOTE

These costs are based on a 4-lane crossing. A 2-lane crossing would cost approximately \$1,400,000.

**Straight
Bridge Element
Bridge Costs**

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by	ACC
Checked by	DWC
Date	JUNE 1977

Sheet
2 of 5

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	1200	C.Y.	BRIDGE EXCAVATION	7.50	9,000.00
	1200	C.Y.	CHANNEL EXCAVATION	5.50	6,600.00
	700	C.Y.	GRAVEL BORROW	3.50	2,450.00
	140	TON	CLASS I DENSE BIT. CONC. TYPE ST	10.50	1,470.00
	140	TON	CLASS I DENSE PROTECTIVE (BOTTOM) COURSE FOR BRIDGES	28.00	3,920.00
	1400	L.F.	GRANITE CURB TYPE VA-5-STRAIGHT	10.00	14,000.00
	2100	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	294,000.00
	170	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	272,000.00
	220,000	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	88,000.00
	7500	L.F.	STEEL PILE HP 12 IN. 53 LB.	17.00	127,500.00
	8	EA	TEST PILE	900.00	7,200.00
	3	EA	PILE LOADING TEST	7,000.00	21,000.00
	110,000	LB.	STEEL SHEETING	0.50	55,000.00
	18,680	SF.	PRESTRESSED CONCRETE BOX BEAMS	25.00	467,000.00
	1,748	S.Y.	MEMBRANE WATERPROFFING	5.50	9,624.00
	518	S.Y.	BITUMINOUS DAMP-PROFFING	2.00	1,036.00
	1400	L.F.	METAL BRIDGE RAILING (1-RAIL) OPTION	10.00	14,000.00
			BRIDGE ESTIMATE SUBTOTAL		1,149,000.00

S Estimate

CE Engineers

Water Street Bridge Element
 Highway Estimate

ACC Sheet

DWC 3 of 5

15"

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
 Little Mystic Channel Crossing
 Draft Negative Declaration

Computed by

ACC

Sheet

Checked by

DWC

3 of 5

Date JUNE

1977

ITEM NO.	QUANTITY	UNIT	ITEM	ITEM NO.	QUANTITY	UNIT	PRICE	AMOUNT
	17,500	C.Y.	EARTH EXCAVATION				1.75	13,125.00
	33,000	C.Y.	ORDINARY BORROW				3.00	9,900.00
	33,000	C.Y.	GRAVEL BORROW				3.50	10,500.00
	13,000	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS				0.80	10,400.00
	1,000	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE				8.00	8,000.00
	15,250	TON	CLASS I BIT. CONC. BASE COURSE, TYPE I-125				15.00	228,750.00
	0.5000	LB.	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL				0.10	50.00
	15,0105	TON	CLASS I BIT. CONCRETE PAVEMENT, TYPE I-125				15.00	225,157.50
	9.2200	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT				9.00	82,980.00
	12.5500	L.F.	GRANITE CURB TYPE VA-4, CURVED				12.00	150,600.00
	30.2750	S.Y.	CONCRETE SIDEWALK-1 COURSE				10.00	3,027.50
			TOTAL					90,150.00
			SAY TOTAL HIGHWAY ESTIMATE					\$100,000.00

**Straight
Bridge Element
Utility Relocation &
Drainage**

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

Computed by **TRM**

Sheet

Checked by **ACC**

4 of **5**

Date **JUNE 1977**

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	7	EA.	TELEPHONE M.H. RESET (BY OTHERS)	--	--
	2	EA.	GAS GATES RESET (BY OTHERS)	--	--
	10	EA.	LIGHT POLES REMOVED (BY OTHERS)	--	--
	12	EA.	ELECTRIC M.H. RESET (BY OTHERS)	--	--
	7	EA.	CATCH BASIN ABANDONED	250.00	1,750.00
	15	EA.	MANHOLES RESET	200.00	3,000.00
	5	EA.	CATCH BASIN RESET	200.00	1,000.00
	17	EA.	CONSTRUCT CATCH BASIN	1000.00	17,000.00
	8	EA.	CONSTRUCT MANHOLE	1200.00	9,600.00
	510	L.F.	10" R.C.P.	30.00	15,300.00
	240	L.F.	15" R.C.P.	40.00	9,600.00
	50	L.F.	18" R.C.P.	45.00	2,250.00
	6	EA.	FIRE HYDRANT REMOVED AND RESET	600.00	3,600.00
	21	EA.	WATER GATE RESET	200.00	4,200.00
	1	L.S.	SPECIAL WATER MANHOLE	2000.00	2,000.00
	1	EA.	POLICE BOX REMOVED AND RESET	600.00	600.00
			TOTAL		62,900.00
			SAY TOTAL UTILITY RELOCATION AND DRAINAGE		\$ 70,000.00

Estimate

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Project: **Straight**
 Date: **Bridge Element**
 Channel: **Roadway Lighting**

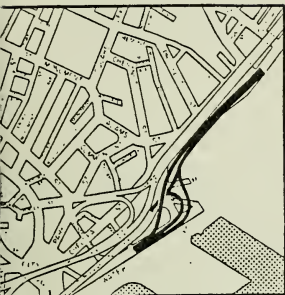
Chelsea - Water Streets Connector
Little Mystic Channel Crossing
Draft Negative Declaration

TRM
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Computed by	TRM	Sheet
Checked by	ACC	5 of 5
Date	JUNE 1977	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	42	EA.	CONSTRUCT LIGHT POLES	2000.00	84,000.00
	42	EA.	PRECAST CONCRETE PULL BOX	300.00	12,600.00
	2	EA.	CONTROL BOX	4000.00	8,000.00
	3300	L.F.	2" CONDUIT	8.00	26,400.00
	8500	L.F.	#4 WIRE	1.00	8,500.00
	3500	L.F.	#10 WIRE	0.70	2,450.00
			TOTAL		141,950.00
			SAY TOTAL ROADWAY LIGHTING		\$ 142,000.00

Utility
Relocation



Construction
Sequence

Water Street and Chelsea Street. Both of these streets will remain basically intact, since the new profiles will generally follow the existing contours. Because of this, there will be no changes with the existing underground utilities. The only changes will be to the manhole covers and gate covers which will have to be raised or lowered to accommodate the new profile. Existing catch basins will either be remodeled or abandoned and new catch basins will be constructed to match the new profile. An improved lighting system will also be provided throughout.

Wapping Street and Henley Street. Both of these streets will be discontinued; however, the existing utilities will remain except in the area of the abutments for the ramp bridge. In this area, a 16-inch water main and a 30- by 24-inch storm sewer may have to be relocated, depending upon foundations for the bridge.

The normal raising and lowering of manhole covers and utility gates will take place.

During the entire construction period, Water Street, the pedestrian walkway from the Bunker Hill Pavilion along the railroad tracks to the U. S. S. Constitution, and Gate 1 will remain open.

Phase I

1. Demolish the U.S. Navy Building No. 204, and the tavern between Chelsea Street and the Mystic River Bridge at Bunker Hill Street.
2. Dismantle the existing Shipyard wall and reconstruct in its new location.
3. Relocate east columns of Bents 7 and 8 on the Mystic River Bridge approach.

Phase II

1. Close existing Henley Street and Wapping Street; however, the Water Street off-ramp will remain open. Close Bunker Hill Street at Chelsea Street.
2. Construct Ramp A from Station 7 + 50 (south abutment) to Station 19 + 60 (northerly limit of Connector). Construct Ramp B from Station 7 + 50 (adjacent to artery) to Station 13 + 40 (merge with Ramp A). Construct Ramp C from Station 7 + 00 to Station 10 + 40 (merge with Ramp B).

Phase III

1. Close the Water Street off-ramp and provide for a temporary connection from the expressway to Ramp B and open Ramp B. Open Gate(s) 4 and/or 5 and provide directional signs to the Bunker Hill Pavilion and the U.S.S. Constitution.
2. Complete construction of Ramps A and C - allowing access to the parking area of the Bunker Hill Pavilion.

Phase IV

1. Either at night or during low volume traffic hours, close the expressway exit to Ramp B and complete construction of Ramp B at the expressway.
2. Close off Bunker Hill Street at Lowney Way
3. Place entire connector into operation.

Alternative 2 Summary Sheet

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	MRW	Sheet 1 of 5
Checked by	KDB	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			HIGHWAY ITEMS SUBTOTAL		914,514.00
	1	L.S.	BRIDGE RAMP A OVER RAMP B	135,000.	135,000.00
	1	L.S.	UTILITY RELOCATION AND DRAINAGE	133,000	133,000.00
	1	L.S.	WALL RELOCATION	125,000.	125,000.00
			TOTAL CONSTRUCTION COSTS		1,307,514.00
	2,000	HR.	TRAFFIC POLICE	8.00	16,000.00
			SUBTOTAL		1,323,514.00
			10% ENGINEERING AND MISCELLANEOUS		136,486.00
			GRAND TOTAL		1,460,000.00

Estimate

Engineers and Consultants

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

ate. Street **Alternative 2**
 c Channel **Roadway Estimate**
 onments Impact Statement

Chelsea-Water Streets Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement

MAP No. **2.5**
 KCE

Computed by **MRW**
 Checked by **KDB**
 Date **OCTOBER 1975**

Sheet
2 of 5

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	5,000	C.Y.	EARTH EXCAVATION	1.75	8,750.00
	17,350	C.Y.	ORDINARY BORROW	3.00	52,050.00
	5,800	C.Y.	GRAVEL BORROW	3.50	20,300.00
	11,180	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	8,944.00
	1,070	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	8,560.00
	3,230	TON	CLASS I BIT. CONC. BASE COURSE - TYPE I-1	15.00	48,450.00
	1	L.S.	TRAFFIC SIGNALS	19,200.	19,200.00
	1,350	TON	CLASS I BIT. CONC. PAVEMENT, TYPE I-1	15.00	20,250.00
	6,500	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	58,500.00
	100	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	1,200.00
	1,555	S.Y.	CONCRETE SIDEWALK-1 COURSE	10.00	15,550.00
	1	L.S.	LOAM AND SEEDING	25,000.	25,000.00
	2,000	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	280,000.00
	140	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	22,400.00
	133,400	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	53,360.00
	1	L.S.	ROADWAY LIGHTING	202,000.	202,000.00
	1	L.S.	RELOCATION OF COLUMNS (B-7 & B-8)	70,000.	70,000.00
			HIGHWAY ITEMS SUBTOTAL		914,514.00

**Alternative 2 :
Utility Relocation &
Drainage**

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	TRM	Sheet 3 of 5
Checked by	ACC	
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	19	EA.	LIGHT POLES REMOVED (BY OTHERS)	--	--
	19	EA.	ELECTRIC M.H. RESET (BY OTHERS)	--	--
	16	EA.	GAS GATES RESET (BY OTHERS)	--	--
	390	L.F.	3" GAS LINE (BY OTHERS)	--	--
	5	EA.	TELEPHONE MANHOLES RESET (BY OTHERS)	--	--
	14	EA.	CATCH BASINS ABANDONED	250.00	3,500.00
	1	EA.	MANHOLES ABANDONED	250.00	250.00
	30	EA.	MANHOLES RESET	200.00	6,000.00
	9	EA.	CONSTRUCT MANHOLE	1200.00	10,800.00
	24	EA.	CONSTRUCT CATCH BASIN	1000.00	24,000.00
	650	L.F.	10" R.C.P.	30.00	19,500.00
	900	L.F.	12" R.C.P.	35.00	31,500.00
	220	L.F.	30" R.C.P.	50.00	11,000.00
	6	EA.	FIRE HYDRANTS (REMOVED AND RESET)	600.00	3,600.00
	37	EA.	WATER GATES RESET	200.00	7,400.00
	200	L.F.	6" D.I. WATER PIPE	30.00	6,000.00
	210	L.F.	16" D.I. WATER PIPE	45.00	9,450.00
			TOTAL-UTILITY RELOCATION & DRAINAGE		\$ 133,000.00

Estimate

Engineers & Consultants

Alternative 2
Roadway Lighting
Draft Environmental Impact Statement

TRM
ACC

4.5

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	TRM	Sheet
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Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	60	EA.	CONSTRUCT LIGHT POLE	2000.00	120,000.00
	3	EA.	CONTROL BOXES	4000.00	12,000.00
	60	EA.	PRECAST CONCRETE PULL BOX	300.00	18,000.00
	4700	L.F.	2" CONDUIT	8.00	37,600.00
	11000	L.F.	#4 WIRE	1.00	11,000.00
	5000	L.F.	#10 WIRE	0.70	3,500.00
			TOTAL		202,100.00
			SAY, TOTAL ROADWAY LIGHTING		\$202,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 2 Traffic Signals

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	RCE	Sheet 5 of 5
Checked by	MRW	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	2	EA.	10' SIGNAL POLE STRUCTURE	405.00	810.00
	8	EA.	3 SECTION VEHICLE HEADS	160.00	1,280.00
	8	EA.	SMALL LOOPS	250.00	2,000.00
	4	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	1,000.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	400	L.F.	CONDUIT - NOT UNDER ROADWAY	3.50	1,400.00
	150	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,650.00
	400	L.F.	CABLE	2.00	800.00
	6	EA.	PULL BOXES	200.00	1,200.00
	1	L.S.	SIGNS	1,200.00	1,200.00
	1	L.S.	PAVEMENT MARKINGS	750.00	750.00
			TOTAL		19,140.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 19,200.00

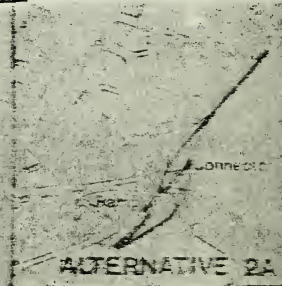
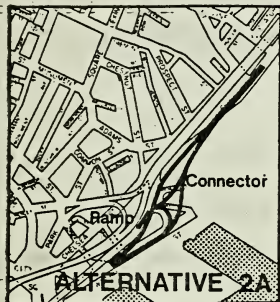
ALTERNATIVE 2A:

Utility
Relocation

See Alternative 2 above.

Construction
Sequence
pedestrian walkway from
railroad tracks to the
Gate

During the entire construction period, Water Street, the pedestrian walkway from the Bunker Hill Pavilion along the railroad tracks to the U.S.S. Constitution, and Gate 1 will remain open.



Phase I

1. Demolish the existing U.S. Navy Building No. 204, and the tavern located between Chelsea Street and the Mystic River Bridge at Bunker Hill Street.
2. Dismantle the existing Shipyard wall and reconstruct in its new location.
3. Relocate the east columns of Bents 7 and 8 on the Mystic River Bridge approach.

Phase II

1. Close existing Henley and Wapping Streets; however, the existing Water Street off-ramp will remain open. Close Bunker Hill Street at Chelsea Street.
2. Construct Ramp A from Station 6 + 80 (south abutment) to Station 19 + 60 (northerly limit of proposed Connector). Construct Ramp B from Station 8 + 00 to Station 13 + 90 (merge with Ramp A). Construct Ramp C from Station 7 + 30 to Station 11 + 00 (merge with Ramp B). Construct Ramp D from Station 7 + 30 to Station 9 + 90.

Phase III

1. Close the Water Street off-ramp and open Ramp C to the north only. Open Gate(s) 4 and/or 5 and provide directional signs to the Bunker Hill Pavilion and the U.S.S. Constitution.
2. Complete construction of Ramp C from Joiner Street Station 1 + 00 to 7 + 30 providing access to the parking lot of the Bunker Hill Pavilion.

Phase IV

1. Either at night or during low volume traffic hours, close the expressway exit to Ramps B and D, and finish construction of Ramp B at the expressway.
2. Close off Bunker Hill Street at Lowney Way.
3. Place entire connector into operation.

Alternative 2A Summary Sheet

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			SUBTOTAL - HIGHWAY ITEMS		938,380.00
	1	L.S.	BRIDGE RAMP A OVER RAMP B	186,000.	186,000.00
	1	L.S.	UTILITY RELOCATION AND DRAINAGE	126,000.	126,000.00
	1	L.S.	WALL RELOCATION	125,000.	125,000.00
			TOTAL CONSTRUCTION COST		1,375,380.00
	2,000	HRS.	TRAFFIC POLICE	8.00	16,000.00
			SUBTOTAL		1,391,380.00
			10% ENGINEERING AND MISCELLANEOUS		138,620.00
			GRAND TOTAL		\$1,530,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Alternative 2A Roadway Estimate

Computed by	MRW	Sheet 2 of 5
Checked by	KDB	
Date	OCTOBER 1975	

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2,200	C.Y.	EARTH EXCAVATION	1.75	3,850.00
	37,630	C.Y.	ORDINARY BORROW	3.00	112,890.00
	6,600	C.Y.	GRAVEL BORROW	3.50	23,100.00
	11,600	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	9,280.00
	1,080	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	8,640.00
	3,400	TON	CLASS I BIT. CONC. BASE COURSE-TYPE I-1	15.00	51,000.00
	1	L.S.	TRAFFIC SIGNALS	19,200.	19,200.00
	1,400	TON	CLASS I BIT. CONC. PAVEMENT, TYPE I-1	15.00	21,000.00
	6,980	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	62,820.00
	100	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	1,200.00
	2,000	S.Y.	CONCRETE SIDEWALK - 1 COURSE	10.00	20,000.00
	1	L.S.	LOAM AND SEEDING	23,400.	23,400.00
	1,560	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	218,400.00
	110	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	17,600.00
	105,000	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	42,000.00
	1	L.S.	ROADWAY LIGHTING	234,000.	234,000.00
	1	L.S.	RELOCATION OF COLUMNS (B-7 & B-8)	70,000.	70,000.00
			SUBTOTAL - HIGHWAY ITEMS		938,380.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Alternative 2A Utility Relocation & Drainage

3.5

Computed by TRM
Checked by ACC
Date OCTOBER 1975

Sheet
3 of 5

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	250	L.F.	3" GAS LINE (BY OTHERS)		
	16	EA.	CAS GATES RESET (BY OTHERS)		
	5	EA.	TELEPHONE M.H. RESET (BY OTHERS)		
	14	EA.	CATCH BASIN ABANDONED	250.00	3,500.00
	31	EA.	MANHOLES RESET	200.00	6,200.00
	28	EA.	CONSTRUCT CATCH BASIN	1000.00	28,000.00
	12	EA.	CONSTRUCT MANHOLE	1200.00	14,400.00
	730	L.F.	10" R.C.P.	30.00	21,900.00
	560	L.F.	12" R.C.P.	35.00	19,600.00
	200	L.F.	30" R.C.P.	50.00	10,000.00
	37	EA.	WATER GATES RESET	200.00	7,400.00
	6	EA.	FIRE HYDRANTS (REMOVED AND RESET)	600.00	3,600.00
	160	L.F.	6" D.I. WATER PIPE	30.00	4,800.00
	150	L.F.	16" D.I. WATER PIPE	45.00	6,750.00
			TOTAL		126,150.00
			SAY TOTAL UTILITY RELOCATION AND DRAINAGE		\$126,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 2A Roadway Lighting

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	TRM	Sheet 4 of 5
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
66	EA.		CONSTRUCT LIGHT POLE	2000.00	132,000.00
66	EA.		PRECAST CONCRETE PULL BOX	300.00	19,800.00
4	EA.		CONTROL BOX	4000.00	16,000.00
5800	L.F.		2" CONDUIT	8.00	46,400.00
15000	L.F.		#4 WIRE	1.00	15,000.00
6000	L.F.		#10 WIRE	0.70	4,200.00
			TOTAL		233,400.00
			SAY TOTAL ROADWAY LIGHTING		\$234,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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Checked by	MRW	5 of 5
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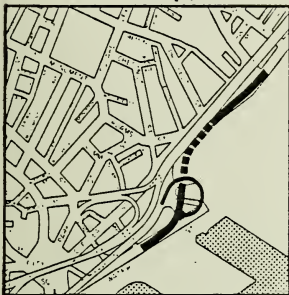
Alternative 2A Traffic Signals

5.5

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	2	EA.	10' SIGNAL POLE STRUCTURE	405.00	810.00
	8	EA.	3 SECTION VEHICLE HEADS	160.00	1,280.00
	8	EA.	SMALL LOOPS	250.00	2,000.00
	4	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	1,000.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	400	L.F.	CONDUIT - NOT UNDER ROADWAY	3.50	1,400.00
	150	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,650.00
	400	L.F.	CABLE	2.00	800.00
	6	EA.	PULL BOXES	200.00	1,200.00
	1	L.S.	SIGNS	1,200.00	1,200.00
	1	L.S.	PAVEMENT MARKINGS	750.00	750.00
			TOTAL		19,140.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 19,200.00

ALTERNATIVE 3:

.2 Utility Relocation



The depressed tunnel profile will require major utility relocations.

Chelsea Street. The existing 18-inch storm drainage line in the northerly half of Chelsea Street will have to be abandoned. A new storm drainage system will have to be constructed next to and parallel to the Mystic River Bridge. This new system will pick up the storm water from the bridge and will connect to the present system located either on Lowney Way or Bunker Hill Street. All other utilities, which include two electric lines, three water lines, one telephone line, and one gas line, will have to be relocated on Lowney Way and connected back into the system either at Bunker Hill Street or Chelsea Street. All existing utilities serving the Shipyard from Chelsea Street will have to be relocated. Replacement lines could be installed through the Gate 4 area.

Henley Street. All existing utilities on this street will be discontinued. If the Shipyard is serviced by any of these utilities, they will have to obtain new service from Water Street. The utilities to be discontinued are a 6-inch water line, 3-inch gas line, and a 6-inch sewer line.

Wapping Street. The existing electric line will be discontinued and the 16-inch water line and the 3-inch gas line will have to be relocated either under or over the proposed tunnel. However, a further study may indicate that both of these lines could be discontinued. The 30- by 24-inch drainage system is a major line for the district of Charlestown and a pump will have to be constructed east of the

Construction Sequence

During the entire construction period, the pedestrian walkway for the Bunker Hill Pavilion along the railroad tracks to the U.S.S. Constitution will remain open. Gate 1 will be very restricted in Phase II unless a temporary detour is provided on the land between the Bunker Hill Pavilion and Gate 1.

Phase I

1. Demolish the U.S. Navy Building No. 204 and the tavern between Chelsea Street and the Mystic River Bridge at Bunker Hill Street.
2. Number, dismantle, and store the existing Shipyard wall.
3. Relocate and underpin the east columns of Bents 7 and 8 of the Mystic River Bridge.
4. Move all existing utilities from Chelsea Street to Lowney Way and relocate the necessary utilities on Water, Wapping, and Henley Streets.

Phase II

1. Close existing Henley Street and Wapping Street; however, the Water Street off-ramp will remain open. Close Bunker Hill Street at Chelsea Street along with Gate 1 to the Shipyard and open Gate 5 to the Shipyard.
2. Construct the Chelsea-Water Street Connector (tunnel) from Station 5 + 50 to Station 17 + 50 (northerly limit of proposed Connector). Construct Ramp A from Station 0 + 50 (at artery) to Station 6 + 00 (just north of Water Street off-ramp). Construct the south retaining wall from Ramp A Station 4 + 80 to Ramp A Station 6 + 00.

Phase III

1. Provide temporary access from the expressway to Ramp A, close the Water Street off-ramp and open Ramp A to Water Street in front of Gate 1 and open Gate(s) 4 and/or 5. Provide directional signs to the Bunker Hill Pavilion and the U.S.S. Constitution.
2. Complete construction of the Chelsea-Water Street Connector from Station 3 + 00 to Station 5 + 50 and Ramp A.
3. Reconstruct the Shipyard wall in its original location.

Phase IV

1. Close Ramp A, temporary access to Water Street near Gate 1 and allow Ramp A traffic on the Connector to travel in the north-bound direction only.
2. Complete Chelsea-Water Street Connector from Station 1 + 00 to Station 3 + 00.

Phase V

1. Either at night or during low volume traffic hours, close the expressway exit to Ramp A and complete construction of Ramp A at the expressway.
2. Close off Bunker Hill Street at Lowney Way.
3. Place entire Connector into operation.

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Alternative 3 Summary Sheet

Computed by	MRW	Sheet 1 of 8
Checked by	KDB	
Date	OCTOBER 1975	

1.8

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			SUBTOTAL, HIGHWAY ITEMS		5,728,460
		L.S.	ROADWAY LIGHTING	68,000	168,000
		L.S.	TUNNEL LIGHTING	50,000	150,000
		L.S.	UTILITY RELOCATION AND DRAINAGE	360,000	360,000
		L.S.	WALL RELOCATION	135,000	135,000
			TOTAL CONSTRUCTION COST		6,541,460
	2000	HRS.	TRAFFIC POLICE	8.00	16,000
			SUBTOTAL		6,557,460
			10% ENGINEERING AND MISCELLANEOUS		642,540
			GRAND TOTAL		7,200,000

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 3 Roadway Estimate

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

Computed by	MRW
Checked by	KDB
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	91,000	C.Y.	EARTH EXCAVATION	1.75	159,250.00
	1,250	C.Y.	ORDINARY BORROW	3.00	3,750.00
	22,600	C.Y.	GRAVEL BORROW	3.50	79,000.00
	5,200	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	4,160.00
	600	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	4,800.00
	1,750	TON	CLASS I BIT. CONC. BASE COURSE, TYPE I-1	15.00	26,250.00
	1	L.S.	TRAFFIC SIGNALS	36,400.	36,400.00
	1,500	TON	CLASS I BIT. CONC. PAVEMENT, TYPE I-1	15.00	22,500.00
	4,500	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	40,500.00
	200	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	2,400.00
	500	S.Y.	CONCRETE SIDEWALK-1 COURSE	10.00	5,000.00
	1	L.S.	LOAM AND SEEDING	12,300.	12,300.00
	21,100	C.Y.	CLASS A CEMENT CONC. MASONRY	140.00	2,954,000.00
	1,350	C.Y.	CLASS C CEMENT CONC. MASONRY	150.00	202,500.00
	550	C.Y.	CLASS D CEMENT CONC. MASONRY	160.00	188,000.00
	1,785,500	LB.	STEEL REINFORCEMENT FOR STRUCTURES	0.40	714,200.00
	10,300	S.Y.	MEMBRANE WATERPROOFING	5.50	56,650.00
	10,300	S.Y.	WATERPROOFING PROTECTIVE COURSE	8.00	82,400.00
	9,650	S.Y.	BITUMINOUS DAMP-PROOFING	2.00	19,300.00
	736,000	LB.	1/4 INCH STEEL PLATE WATERPROOFING	0.35	257,600.00
	5,500	S.Y.	EPOXY COATING FOR TUNNEL WALLS	15.00	82,500.00
	1	L.S.	DEWATERING SYSTEM	275,000.	275,000.00
	200	C.Y.	UNDERPINNING FOUNDATIONS	550.	110,000.00
	200,000	LB.	STEEL SHEETING, LEFT IN PLACE	0.50	100,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 3 Roadway Estimate

(continued from preceding page)

Chelsea-Water Streets Connector Little Mystic Channel Crossing Draft Environmental Impact Statement

Computed by MRW

Checked by KDB

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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
		L.S.	TUNNEL VENTILATION	100,000	100,000
		L.S.	PUMPING STATION	120,000	120,000
		L.S.	RELOCATION OF COLUMNS (B7 & B8)	70,000	70,000
			SUBTOTAL, HIGHWAY ITEMS		5,728,460

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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Alternative 3 Utility Relocation & Drainage

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	7	EA.	GAS GATES RESET (BY OTHERS)	--	--
	780	L.F.	3" GAS LINE (BY OTHERS)	--	--
	1230	L.F.	8" GAS LINE (BY OTHERS)	--	--
	1180	L.F.	TELEPHONE LINE (BY OTHERS)	--	--
	20	EA.	REMOVE LIGHT POLES (BY OTHERS)	--	--
	4	EA.	ELECTRIC M.H. RESET (BY OTHERS)	--	--
	4	EA.	ELECTRIC M.H. ABANDONED (BY OTHERS)	--	--
	2100	L.F.	ELECTRIC LINES (BY OTHERS)	--	--
	5	EA.	MANHOLES RESET	200.00	1,000.00
	7	EA.	MANHOLES ABANDONED	250.00	1,750.00
	1	EA.	CATCH BASIN REMODELED	500.00	500.00
	11	EA.	CATCH BASIN ABANDONED	250.00	2,750.00
	16	EA.	CONSTRUCT CATCH BASIN	1000.00	16,000.00
	9	EA.	CONSTRUCT MANHOLE	1200.00	10,800.00
	4	EA.	CONSTRUCT SPECIAL MANHOLE	2200.00	8,800.00
	300	L.F.	10" R.C.P.	30.00	9,000.00
	70	L.F.	12" R.C.P.	35.00	2,450.00
	360	L.F.	30" R.C.P.	45.00	16,200.00
	400	L.F.	10" D.I. PIPE	35.00	14,000.00
	1550	L.F.	12" D.I. PIPE	40.00	62,000.00
	800	L.F.	16" D.I. PIPE	45.00	36,000.00
	880	L.F.	18" D.I. PIPE	50.00	44,000.00
	1240	L.F.	20" D.I. PIPE	55.00	68,200.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 3 Utility Relocation & Drainage

continued from preceeding page

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	860	L.F.	24" D.I. PIPE	60.00	51,600.00
	50	L.F.	30" D.I. PIPE	75.00	3,750.00
	240	L.F.	6" D.I. PIPE	25.00	6,000.00
	12	EA.	WATER GATES RESET	200.00	2,400.00
	4	EA.	FIRE HYDRANT REMOVED AND RESET	600.00	2,400.00
			TOTAL		359,600.00
			SAY TOTAL UTILITY RELOCATION AND DRAINAGE		\$360,000.00
	1	L.S.	PUMPING STATION	120000.00	120,000.00
	1	L.S.	TUNNEL VENTILATION SYSTEM	100000.00	100,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 3 Roadway Lighting

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	48	EA.	CONSTRUCT LIGHT POLE	2000.00	96,000.00
	48	EA.	PRECAST CONCRETE PULL BOX	300.00	14,400.00
	3	EA.	CONTROL BOX	4000.00	12,000.00
	4000	L.F.	2" CONDUIT	8.00	32,000.00
	10000	L.F.	#4 WIRE	1.00	10,000.00
	4500	L.F.	#10 WIRE	0.70	3,150.00
			TOTAL		167,550.00
			SAY TOTAL ROADWAY LIGHTING		\$ 168,000.00
	1	L.S.	TUNNEL LIGHTING	150,000.	150,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 3 Traffic Signals

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	2	EA.	10' SIGNAL POLE STRUCTURE	405.00	810.00
	8	EA.	3 SECTION VEHICLE HEADS	160.00	1,280.00
	8	EA.	SMALL LOOPS	250.00	2,000.00
	4	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	1,000.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	400	L.F.	CONDUIT - NOT UNDER ROADWAY	3.50	1,400.00
	150	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,650.00
	400	L.F.	CABLE	2.00	800.00
	6	EA.	PULL BOXES	200.00	1,200.00
	1	L.S.	SIGNS	1,200.00	1,200.00
	1	L.S.	PAVEMENT MARKINGS	750.00	750.00
			TOTAL		19,140.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 19,200.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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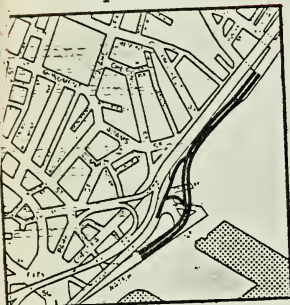
Alternative 3 Ramp Signals

ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	3	EA.	10' SIGNAL POLE STRUCTURE	405.00	1,215.00
	7	EA.	3 SECTION VEHICLE HEADS	160.00	1,120.00
	2	EA.	LONG LOOPS	500.00	1,000.00
	4	EA.	SMALL LOOPS	250.00	1,000.00
	3	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	750.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	300	L.F.	CONDUIT-NOT UNDER ROADWAY	3.50	1,050.00
	100	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,100.00
	300	L.F.	CABLE	2.00	600.00
	4	EA.	PULL BOXES	200.00	800.00
	1	L.S.	SIGNS	1,000.00	1,000.00
	1	L.S.	PAVEMENT MARKINGS	500.00	500.00
			TOTAL		17,185.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 17,200.00

ALTERNATIVE 4:

Utility Relocations

Construction Sequence



The necessary utility relocations for Alternative 4 are the same as for Alternatives 2 and 2A. Please refer to Section IV.D.2 for detailed description.

During the entire construction period, the pedestrian walkway from the Bunker Hill Pavilion along the railroad tracks to the U.S.S. Constitution will remain open.

Phase I

1. Demolish the U.S. Navy Building No. 204, and the tavern between Chelsea Street and the Mystic River Bridge at Bunker Hill Street.
2. Dismantle the existing Shipyard wall and reconstruct in its new location.
3. Relocate east columns of Bents 7 and 8 on the Mystic River Bridge approach.

Phase II

1. Close existing Henley Street and Wapping Street; however, the Water Street artery off-ramp will remain open. Close Bunker Hill Street at Chelsea Street.
2. Construct Ramp A and Ramp B.
3. Construct Connector from Station 4 + 00 (junction with Water Street) to the northerly limit of the Connector.

Phase III

1. Close the Water Street off-ramp and open Ramp A for northbound traffic.
2. Construct the connector on Water Street from Station 0 + 00 to Station 4 + 00. Southbound traffic will use the new Ramp B and be detoured through the Water Street construction. This southbound detour would be required for a period of 6 to 8 weeks, until Water Street is reconstructed.

Phase IV

1. Close off Bunker Hill Street at Lowney Way.
2. Place entire connector into operation.

Alternative 4

Summary Sheet

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement

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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
			HIGHWAY ITEMS SUBTOTAL		510,467.50
	1	L.S.	UTILITY RELOCATION AND DRAINAGE	133,000	133,000.00
	1	L.S.	WALL RELOCATION	125,000	125,000.00
			TOTAL CONSTRUCTION COSTS		768,467.50
	2,000	HR.	TRAFFIC POLICE	8.00	16,000.00
			SUBTOTAL		784,467.50
			10% ENGINEERING AND MISCELLANEOUS		75,532.50
			GRAND TOTAL		\$860,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea - Water Streets Connector
Little Mystic Channel Crossing
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	9,050	C.Y.	EARTH EXCAVATION	1.75	15,837.50
	550	C.Y.	ORDINARY BORROW	3.00	1,650.00
	2,700	C.Y.	GRAVEL BORROW	3.50	9,450.00
	12,000	S.Y.	FINE GRADING & COMPACTING-SUBGRADE AREAS	0.80	9,600.00
	1,250	C.Y.	DENSE GRADED CRUSHED STONE FOR SUBBASE	8.00	10,000.00
	3,850	TON	CLASS I BIT. CONC. BASE COURSE - TYPE I-1	15.00	57,750.00
	1	L.S.	TRAFFIC SIGNALS		36,400.00
	1,600	TON	CLASS I BIT. CONC. PAVEMENT, TYPE I-1	15.00	24,000.00
	4,000	L.F.	GRANITE CURB TYPE VA-4, STRAIGHT	9.00	36,000.00
	250	L.F.	GRANITE CURB TYPE VA-4, CURVED	12.00	3,000.00
	1,400	L.F.	GRANITE EDGING - TYPE SB-STRAIGHT	6.00	8,400.00
	38	L.F.	GRANITE EDGING-TYPE SB-RADIUS LESS THAN 10'	10.00	380.00
	1,000	S.Y.	CONCRETE SIDEWALK-1 COURSE	10.00	10,000.00
	1	L.S.	LOAM AND SEEDING		16,000.00
	1	L.S.	ROADWAY LIGHTING	202,000	202,000.00
	1	L.S.	RELOCATION OF COLUMNS (B-7 & B-8)	70,000	70,000.00
			HIGHWAY ITEMS SUBTOTAL		510,467.50

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 4 Utility Relocation & Drainage

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	19	EA.	LIGHT POLES REMOVED (BY OTHERS)	--	--
	19	EA.	ELECTRIC M.H. RESET (BY OTHERS)	--	--
	16	EA.	GAS GATES RESET (BY OTHERS)	--	--
	390	L.F.	3" GAS LINE (BY OTHERS)	--	--
	5	EA.	TELEPHONE MANHOLES RESET (BY OTHERS)	--	--
	14	EA.	CATCH BASINS ABANDONED	250.00	3,500.00
	1	EA.	MANHOLES ABANDONED	250.00	250.00
	30	EA.	MANHOLES RESET	200.00	6,000.00
	9	EA.	CONSTRUCT MANHOLE	1200.00	10,800.00
	24	EA.	CONSTRUCT CATCH BASIN	1000.00	24,000.00
	650	L.F.	10" R.C.P.	30.00	19,500.00
	900	L.F.	12" R.C.P.	35.00	31,500.00
	220	L.F.	30" R.C.P.	50.00	11,000.00
	6	EA.	FIRE HYDRANTS (REMOVED AND RESET)	600.00	3,600.00
	37	EA.	WATER GATES RESET	200.00	7,400.00
	200	L.F.	6" D.I. WATER PIPE	30.00	6,000.00
	210	L.F.	16" D.I. WATER PIPE	45.00	9,450.00
			TOTAL-UTILITY RELOCATION & DRAINAGE		\$ 133,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Alternative 4 Roadway Lighting

Chelsea Water Streets Connector
Little Mystic Channel Crossing
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	60	EA.	CONSTRUCT LIGHT POLE	2000.00	120,000.00
	3	EA.	CONTROL BOXES	4000.00	12,000.00
	60	EA.	PRECAST CONCRETE PULL BOX	300.00	18,000.00
	4700	L.F.	2" CONDUIT	8.00	37,600.00
	11000	L.F.	#4 WIRE	1.00	11,000.00
	5000	L.F.	#10 WIRE	0.70	3,500.00
			TOTAL		202,100.00
			SAY, TOTAL ROADWAY LIGHTING		\$202,000.00

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
Little Mystic Channel Crossing
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	2	EA.	10' SIGNAL POLE STRUCTURE	405.00	810.00
	8	EA.	3 SECTION VEHICLE HEADS	160.00	1,280.00
	8	EA.	SMALL LOOPS	250.00	2,000.00
	4	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	1,000.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	400	L.F.	CONDUIT - NOT UNDER ROADWAY	3.50	1,400.00
	150	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,650.00
	400	L.F.	CABLE	2.00	800.00
	6	EA.	PULL BOXES	200.00	1,200.00
	1	L.S.	SIGNS	1,200.00	1,200.00
	1	L.S.	PAVEMENT MARKINGS	750.00	750.00
			TOTAL		19,140.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 19,200.00

Alternative 4 Ramp Signals

Engineers Estimate

EDWARDS & KELCEY, Engineers and Consultants

Chelsea-Water Streets Connector
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ITEM NO.	QUANTITY	UNIT	ITEM	UNIT PRICE	AMOUNT
	2	EA.	25' MAST ARM STRUCTURE	1,525.00	3,050.00
	3	EA.	10' SIGNAL POLE STRUCTURE	405.00	1,215.00
	7	EA.	3 SECTION VEHICLE HEADS	160.00	1,120.00
	2	EA.	LONG LOOPS	500.00	1,000.00
	4	EA.	SMALL LOOPS	250.00	1,000.00
	3	EA.	LOOP DETECTOR, OSC. AND RELAY	250.00	750.00
	1	EA.	FULLY ACTUATED CONTROLLER	4,000.00	4,000.00
	300	L.F.	CONDUIT-NOT UNDER ROADWAY	3.50	1,050.00
	100	L.F.	CONDUIT - UNDER ROADWAY	11.00	1,100.00
	300	L.F.	CABLE	2.00	600.00
	4	EA.	PULL BOXES	200.00	800.00
	1	L.S.	SIGNS	1,000.00	1,000.00
	1	L.S.	PAVEMENT MARKINGS	500.00	500.00
			TOTAL		17,185.00
			SAY TOTAL TRAFFIC SIGNALS		\$ 17,200.00



TRAFFIC PROJECTION METHODOLOGY

Several sources of traffic information were used in developing the traffic assignments and their distributions, including the following: vehicular classification and turning movement counts; supplementary peak hour traffic counts; a Traffic Origin and Destination Study of the City Square off-ramp and Medford/Terminal Street areas. The MDPW Bureau of Transportation Planning and Development participated in the conduct of the O & D survey along with the BRA Planning, Engineering and Development and the Transportation Planning Departments of the BRA.

The following data were derived from these surveys:

1. Sample Size for 8-Hour Survey Period by Station
2. Factor Size for 1) Autos and 2) Trucks by Hour and Survey Station
3. Trip Origin and Destination Matrices by Hour and Survey Station
4. Vehicular Classification by Survey Hour and Station
5. Summary: 8-Hour Factored Vehicular Classification Count by Station
6. Summary: Trip Origin and Destination Information by Travel Corridor for Combined 8-Hour Survey Period (3 of the 4 Survey Stations are complete)
7. Other items which have been coded, factored and summarized by survey station and percentage distribution, include:
 - Passengers Carried
 - Driver's Residence
 - Trip Purpose-All Vehicular Traffic
 - Truck Garaged
 - Truck Fuel Type
 - Trip Purpose-Trucks Only
 - Approach Route
8. The following traffic counts have been completed:

11-Hour Traffic Classification Count:

Medford and Terminal Streets
City Square off-ramp

P.M. Peak Classification Counts:

Rutherford Avenue
Main Street
Bunker Hill Street
Medford Street

Intersection Counts:

Medford and Terminal Streets (A.M.
and P.M. Peak)
Lowney Way and Bunker Hill Street
(A.M. and P.M. Peak)
Water and Joiner Streets (P.M. Peak
only)
Water and Grey Streets (P.M. Peak
only)

9. Existing Traffic Counts

- a. Tobin Bridge
- b. I-93
- c. Prison Point Bridge and Rutherford
Avenue

Trip generation estimates were prepared for affected land uses. National Park and northern Shipyard redevelopment traffic demand estimates were prepared during prior BRA/EDIC studies of the area. Other estimates, such as for Moran Terminal expansion, were obtained from property owners.

Since the study corridor primarily accomodates local or internal-external trips, the proposed improvements are not expected to generate any significant increase in the volume of through traffic.

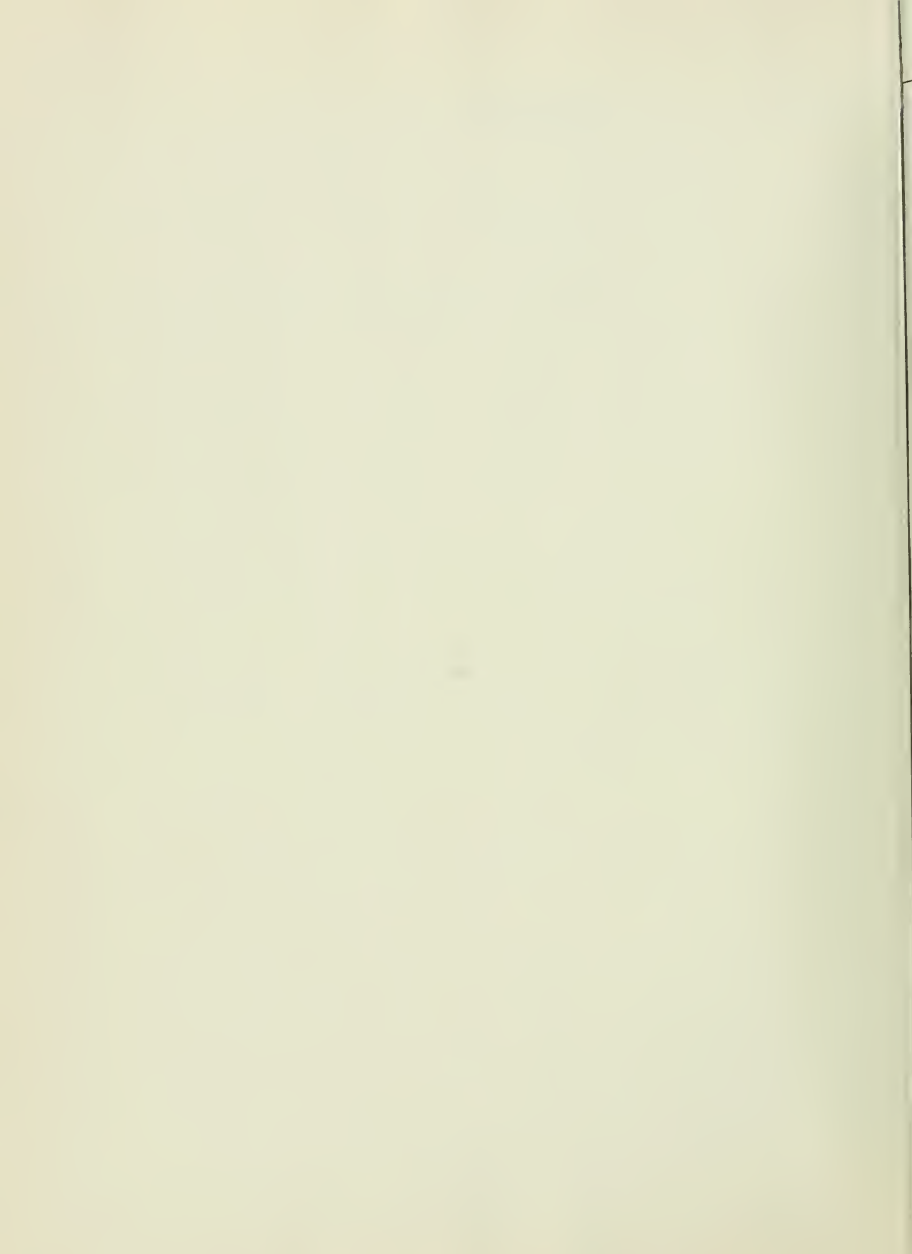
The state generally includes Average Daily Traffic (ADT) assignments for the purposes of project analysis. In the case of the proposed Chelsea-Water Connection, it was decided after consultation with MDPW in Jan. 1976 not to provide ADT's because of the nature of the City's traffic data base which is composed primarily of 11-hour (7 a.m. - 6 p.m.) intersectional turning movement counts. In addition, it was determined that an adequate test of capacity sufficiency would be gained from the analysis of weekday peak hour traffic volumes.

Weekday PM peak hour traffic forecasts were developed for the most intensive combination of

National Park, Moran Terminal expansion, and northern Shipyard redevelopment activities. The land use mix suggested that weekend traffic would not be critical. Traffic assignments and directions of approach on the local street network of each alternative in 1985 and 1995 were made on the basis of the collected traffic data described above.

ITE Handbook standards were followed establishing street and intersection capacities and estimating probable levels of service. Signal phasing was designed to provide intersection capacities equivalent to level of service C.

This approach was judged the most practical for testing the adequacy of roadway and intersection capacities, for design purposes, and in encouraging community understanding and involvement in the proposed transportation improvements.



AIR QUALITY IMPACT ANALYSIS
OF PROPOSED LITTLE MYSTIC CHANNEL
CROSSING IN CHARLESTOWN,
MASSACHUSETTS

By

K. W. Wiltsee, Jr.
Dr. R. D. Siegel
P. H. Guldberg
D. R. Dorman

Prepared by

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Prepared for

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65 Winthrop Street
Cambridge, Massachusetts 02138

December 1, 1975

(C-705)

201 Vassar Street Cambridge Massachusetts 02139

WALDEN RESEARCH DIVISION OF

Abcor inc.

NATURAL ENVIRONMENTAL
IMPACTS
AIR QUALITY

Emissions of motor vehicle-related pollutants will decrease significantly in the design years 1985 to 1995 from 1976 levels as a result of Federal new car emission standards and the effects of the Boston Transportation Control Plan.

No-Build. Carbon monoxide (CO) concentrations will be approximately 50 percent less in the design years 1985 and 1995 than in 1976 at all locations in the project area. No exceedances of the 1-hour CO air quality standards are expected to occur in 1985 or 1995. Exceedances of the 8-hour standard for CO will occur in City Square for these design years.

Alternatives 2, 2A, and 3. Carbon monoxide levels along Medford Street will improve significantly from the projected no-build levels in each of the future design years. Carbon monoxide levels in the vicinity of Gate #1 of the Navy Yard will be 10 to 50 percent higher in each of the design years; however, air quality standards will not be exceeded. At all other locations, Alternatives 2, 2A, and 3 will result in no significant change from the CO concentrations expected as a result of the no-build case.

Alternative 4. Carbon monoxide levels along Medford Street will improve significantly from the projected no-build levels in 1985 and 1995. Carbon monoxide levels in the vicinity of Gate #1 of the Navy Yard are expected to increase as a result of this Alternative; the 8-hour standard for carbon monoxide will be exceeded at this site in 1995 if full redevelopment of the northern Shipyard occurs. Given the capacity constraint of Alternative 4 (approximately 50% of Alternatives 2, 2A and 3), it is more likely that full redevelopment will not occur and that resulting CO concentrations will not exceed the 8-hour standard in 1995. At all other locations, Alternative 4 will result in no significant change from CO concentrations expected as a result of the no-build case.

REPORT OUTLINE

AIR QUALITY

Summary of Air Quality Impacts

Introduction

Analysis Objectives

Emissions from Motor Vehicles

Ambient Air Quality Standards

Transportation Control Plans

General

Metropolitan Boston Transportation Control Plan

Background Data for Project Area

Regional Emissions

Current Air Quality Levels

State Air Monitoring Data

Measured Air Quality

Description of Sites/Procedures

Statistical Analysis of Meteorological Data

Statistical Analysis of Carbon Monoxide Data

Air Quality Modeling Analysis

Description of Atmospheric Diffusion Model

Meteorological Factors

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Appendices

A.1 Air Quality Monitoring and Analysis Program

- a. Measured Air Quality Data
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- e. Oxides of Sulfur
- f. Particulates

SUMMARY OF AIR QUALITY IMPACTS

Air quality data were collected over a 60-day period from September 5 through November 4, 1975, at a site located on Building 204, adjacent to Gate #2 of the Boston Shipyard, and to the Tobin Bridge. Instrumentation at the site included carbon monoxide and wind speed/wind direction monitors.

During this period, there were no exceedances of Federal or State air quality standards for carbon monoxide recorded at the site. Statistical projection of the monitoring data indicated that no exceedance of air quality standards most probably occurred at this site during 1975.

Detailed modeling simulations were conducted for three design years: 1976, 1985, and 1995. Each of the four build alternatives, plus a no-build alternative, was evaluated using two traffic projection scenarios for each alternative and design year. Two levels of impact analysis were conducted. One was a macroscale analysis, a study of the change in total emissions of three motor vehicle-related pollutants -- carbon monoxide, hydrocarbons, and nitrogen oxides -- which would occur in the Charlestown area as a result of the project implementation. The purpose of the macroscale analysis is to provide an indication of the effect of the project on regional photochemical oxidant concentrations. Both nitrogen oxides and hydrocarbons are recognized as precursors to atmospheric oxidants.

The second was a microscale analysis of the change in carbon monoxide concentrations which would result at a number of receptor sites throughout the area. The latter predictions were used to evaluate the impact of the build alternatives on community efforts toward achievement and maintenance of the Federal Air Quality Standards for carbon monoxide. A microscale analysis of nitrogen oxides and hydrocarbons was not conducted. Although motor vehicles are also major contributors to community nitrogen oxide and reactive hydrocarbon emissions, these species participate in a series of complex photochemical reactions for which the current atmospheric diffusion modeling technology does not permit preparation of reliable estimates of projected concentration levels. Therefore, emphasis was placed principally on carbon monoxide concentration levels, as this pollutant is relatively inert. In addition, carbon monoxide is the pollutant emitted in the

largest quantities from automotive sources and possesses the greatest potential for exceeding Federal and Massachusetts air quality standards.

The results of the macroscale analysis indicated that total emissions of all motor vehicle-related pollutants resulting from the build options in each design year would be less than or equal to the emissions expected as a result of the no-build case.

The analysis of carbon monoxide concentrations resulting from each of the alternatives indicates that Build Alternatives 2, 2A, 3 and 4, will not hinder the maintenance of air quality standards at any site where achievement of the standards is predicted to occur. No exceedances of the 1-hour carbon monoxide standard will occur in 1985 or 1995 as a result of implementation of the build alternatives. The 8-hour standards will be exceeded by all the alternatives at City Square in 1995.

INTRODUCTION OF ANALYSIS OBJECTIVES

The primary objective of the air quality analysis was to evaluate the impact of each of the four build alternatives on projected air quality levels in the project area. These air quality levels were then compared with the projected air quality levels in a comparable time period which would result if the project were not built (the No-Build Case). The results were also compared with Federal and State ambient air quality standards and with the goals of the Boston Transportation Control Plan to determine the effect of the alternatives on attainment and maintenance of air quality standards, as specified by the Clean Air Act.

EMISSIONS FROM MOTOR VEHICLES

The principal contaminants emitted by motor vehicles are carbon monoxide, unburned and partially burned hydrocarbons, oxides of nitrogen, partial oxidation products, sulfates, and particulate matter. The particulate matter in exhaust emissions consists of both inorganic and organic compounds of high molecular weight. A brief review of the known effects of these air pollutants on health, materials, and other receptors is presented in Appendix A.2.

In 1972, gasoline-powered motor vehicles contributed 54 percent of all hydrocarbons, 74 percent of all carbon monoxide, and 28 percent of all nitrogen oxides emitted into the air in the United States. The motor vehicle presently constitutes the greatest contributor by volume to air pollution in the urban environment. In some cities, this contribution is as much as 90 percent of the total. This situation can be expected to continue to exist until Federal and State control plans are fully implemented.

The Federal Clean Air Act of 1970 required that procedures to reduce emissions be adopted. The present schedule of stringent Federal regulations on motor vehicle emission control is designed to reduce emissions in new 1978 automobiles by 90 percent from corresponding 1970 motor vehicle emissions. However, the full effect of these regulations will not be felt until the middle 1980s, when virtually every vehicle on the road will be controlled. In Boston, the effect of these controls on air quality will be further enhanced by traffic control regulations recently revised by the Environmental Protection Agency (EPA). These regulations are described below, under "Transportation Control Plans."

The historical sequence in the development of a plan to control the emission of these pollutants and to enhance the quality of the ambient air has included the preparation by EPA of Air Quality Criteria, followed by the promulgation of Ambient Air Quality Standards. The Air Quality Criteria represent an assembly of current scientific knowledge on the relationship between various concentrations of contaminants in the air and their adverse effects on human beings and their environment. Based on this information, as well as on data collected at public hearings, National Ambient

Air Quality Standards (NAAQS) were established.

AMBIENT AIR QUALITY STANDARDS

National primary and secondary Air Quality Standards for both Set I pollutants (sulfur oxides and total suspended particulates) and Set II pollutants (carbon monoxide, nitrogen oxides, hydrocarbons, and photochemical oxidants) were promulgated by the EPA on April 13, 1971. These standards prescribe contaminant exposures which should not be exceeded and form the basis for designing legally enforceable abatement programs. The primary standards are intended to protect the public health, while secondary standards are intended to protect the public welfare from any known or anticipated adverse effects. These national standards are summarized in Table E-1. The target date for attainment of the national primary standards is May 31, 1975, while the secondary standards are to be achieved within a reasonable period of time. The table shows that the primary and secondary standards for Set II pollutants, which are largely transportation source pollutants, are identical. Achievement of these standards in the Metropolitan Boston Air Quality Control Region has been extended to mid-1977 to allow sufficient time to implement a transportation control plan.

TRANSPORTATION CONTROL PLANS

General

Under the Clean Air Act of 1970, all states were required to submit plans for meeting the National Ambient Air Quality Standards set by EPA in 1971. Transportation Control Plans (TCPs) are required for any air quality control region where controls on stationary sources--such as power plants and other industries--combined with Federal new car emission standards are inadequate to ensure attainment or maintenance of the ambient standards.

To meet air quality standards, many major urban areas, including Boston, must control emissions from motor vehicles to a greater extent than would be afforded by the Federal new car emission controls. The effectiveness of a given control strategy must be weighed against alternative measures making up the total control plan with regard to both the reduction in air pollution it offers and the social and economic dislocation the area might suffer in the process.

TABLE E-1
FEDERAL AND MASSACHUSETTS AIR QUALITY STANDARDS

Contaminant	Averaging Time	Concentration				Measurement Criteria*
		Primary Std. ($\mu\text{g}/\text{m}^3$)	Std. (ppm)	Sec. Std. ($\mu\text{g}/\text{m}^3$)	Std. (ppm)	
Sulfur Oxides (SO_2)	Year	80	0.03	—	—	Arithmetic Mean
	Day	365	0.14	—	—	Maximum
	3 Hours	—	—	1,300	0.5	Maximum
Total Suspended Particulates (TSP)	Year	75	—	60**	—	Geometric Mean
	Day	260	—	150	—	Maximum
Carbon Monoxide (CO)	8 Hours	10,000	9	10,000	9	Maximum
	1 Hour	40,000	35	40,000	35	Maximum
Photochemical Oxidants (O_3)	1 Hour	160	0.08	160	0.08	Maximum
Hydrocarbons (Non-Methane)	3 Hours	160***	0.24	160	0.24	Maximum between 6 a.m. and 9 a.m.
Nitrogen Oxides (NO_2)	Year	100	0.05	100	0.05	Arithmetic Mean

* Standards other than those based on annual arithmetic or geometric mean are not to be exceeded more than once per year.

** For use as a guide in assessing implementation plans to achieve the 24-hour TSP standard.

*** For use as a guide in devising implementation plans to achieve the oxidant standard.

In general, two broad types of transportation controls have been considered: those which reduce emissions from individual motor vehicles such as installation of "retrofit" devices on each uncontrolled car, and those which reduce emissions from all vehicles as a class, such as a restriction on vehicle miles traveled. Most plans submitted to EPA by the states employ a combination of such strategies to meet the required air quality standards. The most common strategies included are inspection and maintenance programs; installation of so-called "air bleed" devices to control automobile emissions; and traffic control measures such as traffic flow improvement, mass transit improve-

ment, parking bans, exclusive bus lanes, car pooling, and methods to cut back the total vehicle miles traveled.

Metropolitan Boston Transportation Control Plan

The revised Boston Transportation Control Plan (BTCP) proposed by EPA on June 12, 1975, is composed of a series of land use and transportation control procedures. The principal elements of the Plan are shown in Table, E-2, along with the projected dates of implementation. The proposed program has two main elements:

1. An inspection and maintenance system, to ensure that the pollution control equipment on each registered automobile remains in suitable working order.
2. A program of parking restrictions and other incentives for reducing single-passenger commuter automobile use.

BACKGROUND DATA FOR PROJECT AREA

REGIONAL EMISSIONS

The proposed project site is located within the Metropolitan Boston Air Pollution Control District (APCD). The geographic limits of this district are shown in Figure E-1 and include 102 cities and towns in the Metropolitan area. The emission of air contaminants in the community can be characterized from a 1970 source inventory study [1]. These data represent an accounting of pollutant emissions classified by type of source, type of contaminant, and geographic area. Table E-3 shows in abstract form these data for the Metropolitan Boston APCD. The significance of these data is that 99 percent of carbon monoxide emissions, 70 percent of hydrocarbon emissions, and 53 percent of nitrogen oxide emissions are due to gasoline- and diesel-powered motor vehicles. Furthermore, gasoline-powered vehicles comprise the bulk of these emissions. The tabulations also indicate a component of automotive-related hydrocarbon emissions in the form of gasoline evaporation from bulk storage and marketing facilities for motor fuels.

Table E-4 shows a summary of projected emissions from transportation sources in a 0.471

TABLE E-2

SUMMARY OF THE REVISED METROPOLITAN BOSTON TRANSPORTATION CONTROL PLAN*

Control Strategy	Projected Date of Full Implementation
I. SEMI-ANNUAL INSPECTION/MAINTENANCE PROGRAM All Light- and Medium-Duty Vehicles (10,000 pounds gross vehicle weight or less)	August 1, 1976
II. PARKING MANAGEMENT PROGRAM	
A. Morning On-Street Parking Ban**	March 1, 1977
B. Commercial Off-Street Parking Freeze***	October 15, 1973
C. Restrictions on Construction or Modification of Parking Facilities	†
III. COMMUTER AUTOMOBILE USE REDUCTION	
A. Mandatory Incentive Measures by Commuter-Attracting Facilities†† to Reduce Single-Passenger Commuting Vehicle Usage by 25%	June 30, 1976
B. Commuter Carpool Matching Program	June 30, 1975
C. Feasibility Study of Preferential Bus and Carpool Incentives	December 31, 1974
D. Study of Improved Bicycle Pathways and Facilities	June 30, 1976
IV. CO "HOT SPOT" CONTROL STRATEGIES	May 31, 1977
V. ORGANIC SOLVENT USE REGULATIONS	May 31, 1977

* Includes amendments proposed by EPA on June 12, 1975 [40FR25152, 40CFR52]. All regulations refer to the Metropolitan Boston Intra-state Air Quality Control Region unless otherwise noted.

** Applies only to Boston proper and the City of Cambridge.

*** Applies only to the "freeze area" of Boston, the City of Cambridge, and Logan International Airport.

† Reserved pending promulgation of final parking management regulations.

†† Employers with a facility having 50 or more employees and educational institutions with 250 or more commuting students and employees.

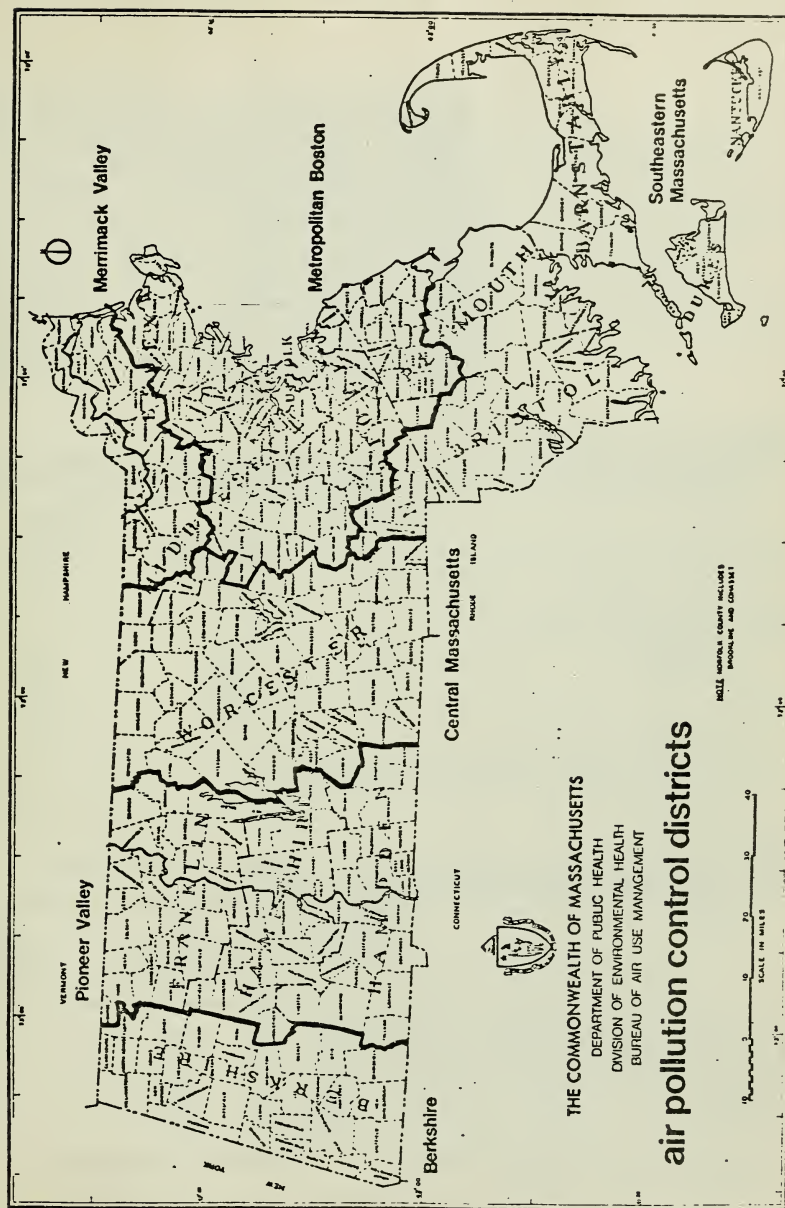


FIGURE E-1

square mile grid square in Charlestown near the project from a 1972 study [2] for two design years. The summary emphasizes the dominant role of light-duty motor vehicles in local community contaminant emissions, particularly for carbon monoxide. The significance of these data is that total vehicular CO emissions in the project area will decline with time, even in the absence of transportation controls. However, the 1972 study indicates that this decline will be inadequate to achieve appropriate air quality standards by the 1977 deadline. Table E-4 also shows the approximate effect of the Boston Transportation Control Plan on emissions in the project area.

TABLE E-3
SUMMARY OF POLLUTANT EMISSIONS IN THE METROPOLITAN BOSTON AREA (1970)

Source	Pollutant (1000 tons/year)		
	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Stationary Sources	6	36	72
Transportation Sources			
Automobile	694	118	77
Diesel	5	1	5
Other*	<u>3</u>	<u>14</u>	<u>2</u>
TOTAL	708	169	156
* Railroads, vessels, gasoline marketing			

TABLE E-4
SUMMARY OF BACKGROUND CARBON MONOXIDE EMISSIONS - MOBILE SOURCES* - FOR A SAMPLE CHARLESTOWN GRID SQUARE

Source	Year (tons/year) 1970	1977 (without transportation controls)	1977 (with transportation controls)
Light-Duty Gasoline Motor Vehicles	1419	684	526
Heavy-Duty Gasoline Motor Vehicles	273	208	206
Other Motor Vehicles	<u>26</u>	<u>27</u>	<u>27</u>
TOTAL	1718	919	759

* Stationary source contributions are negligible by comparison to transportation sources.

CURRENT AIR QUALITY LEVELS

State Air Monitoring Data

The Bureau of Air Quality Control of the Commonwealth of Massachusetts operates several air quality monitoring stations throughout the Metropolitan Boston area to comply with the requirements of the Massachusetts State Implementation Plan. Ambient air quality data were obtained from the Bureau for carbon monoxide (CO) at three urban locations in Boston. These data are summarized in Table E-5. These data are discussed below, in relation to carbon monoxide levels measured in the project area by Walden Research.

Local Measured Air Quality

Description of Sites/Procedures

(1) Site Location. Examination of the project area indicated that the area likely to have the greatest change in CO levels as a result of project implementation would be the vicinity of Gates 1 and 2 of the Boston Naval Shipyard. This area is near the southern end of the proposed Water-Chelsea Street connector. A site to monitor present air quality was selected from this area. The site chosen was the roof of an abandoned building (#204) belonging to the Navy and adjacent to the Tobin Bridge, a major artery in the area. The roof is at approximately the same elevation as the upper level of this bridge. Instruments for the detection of CO, wind speed, and wind direction were installed at this site. The CO probe tip was located about 40 feet from the bridge roadway, 30 feet above the ground, and three feet away from all structural facades.

(2) Methodology, Analysis, and Operating Procedures. Meteorological and carbon monoxide data were collected for a 60-day period commencing September 4, 1975. Data recoverability was defined as the percentage of total sampling time that measured data, judged acceptable according to EPA Quality Assurance Criteria [3], were collected. Table

E-6 summarizes the recoverability of the data collected in this program by parameter. When applicable, all measurements and operating procedures corresponded to the EPA referee procedures specified for ambient aerometric monitoring. These procedures are summarized in Appendices A.1.b and A.1.c.

TABLE E-5

CARBON MONOXIDE CONCENTRATIONS (PPM) MEASURED IN METROPOLITAN BOSTON DURING THE TWELVE-MONTH PERIOD ENDING JUNE 1975

		1974				1975			
		Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb. Mar. Apr. May June
<u>Kenmore Square (Boston)</u>									
1-Hour									
Number of Observations	632	684	194	543	670	707	476	235	112 130 640 713
Maximum	12	14	15	16	17	19	22.0	19.0	15.0 10.0 11.0 11.0
Number of Observations	0	0	0	0	0	0	0	0	0 0 0 0
> 35 ppm*									
8-Hour									
Maximum	9.3	11.6	10.8	11.3	14.5	16.0	14.0	14.0	11.0 8.3 8.6 7.9
Number of Observations	1	17	13	9	114	96	102	52	9 0 0 0
> 9 ppm*									
<u>Wellington Circle (Medford)</u>									
1-Hour									
Number of Observations	662	722	655	647	713	744	744	665	729 662 737 713
Maximum	12	11	12	12	25	26	12.0	11.0	11.0 11.0 13.0 7.0
Number of Observations	0	0	0	0	0	0	0	0	0 0 0 0
> 35 ppm*									
8-Hour									
Maximum	6.3	7.1	8.5	8.6	16.1	20.8	5.5	8.1	6.8 5.6 6.4 4.8
Number of Observations	0	0	0	0	28	36	0	0	0 0 0 0
> 9 ppm*									
<u>Science Park (Cambridge)</u>									
1-Hour									
Number of Observations	513	573	713	737	713	729	684	632	722 713 737 706
Maximum	8	8	10	9	12	12	8.0	13.0	10.0 10.0 10.0 8.0
Number of Observations	0	0	0	0	0	0	0	0	0 0 0 0
> 35 ppm*									
8-Hour									
Maximum	4.9	3.9	5.5	7.9	9.8	10.6	5.8	7.4	5.8 6.3 5.6 4.1
Number of Observations	0	0	0	0	4	4	0	0	0 0 0 0
> 9 ppm*									

TABLE E-6
 TIME PERIOD AND VALIDITY OF DATA FROM AMBIENT MONITORING PROGRAM
 IN CHARLESTOWN, MASSACHUSETTS

Parameter	Start Date/Hour	Stop Date/Hour	Percent Valid Data
Carbon Monoxide (CO)	9/9/75-11:00	11/4/75-10:00	71.3%
Wind Speed	9/8/75-12:00	11/4/75-10:00	96.8%
Wind Direction	9/8/75-12:00	11/4/75-10:00	94.5%

(a) Carbon Monoxide (CO). The method employed for CO monitoring was continuous monitoring with a non-dispersive infrared (NDIR) spectrophotometer (Intertech URAS II). This procedure is based on the principle of the absorption of infrared radiation by molecular species such as carbon monoxide. In the analyzer, energy from a source emitting radiation in the infrared region is directed through reference and sample cells. Both beams pass into matched cells, each containing a selective detector and CO. The CO in the cells absorbs infrared radiation at its characteristic frequencies with the detector tuned to those frequencies. After calibration and balancing, a CO sample is introduced into the sample cell. The sample gas absorbs the incident radiation, which reduces the temperature and pressure in the detector cell and displaces a diaphragm. Displacement of the diaphragm is detected electronically and amplified to provide an output signal in proportion to CO concentration to a strip chart recorder.

Two interferences were eliminated before the air sample passed through the analyzer. Particulate matter greater than about $0.6\text{ }\mu\text{m}$ was filtered out by a high-efficiency (99.9999+ %) epoxy bonded glass fiber filter, and water vapor was removed via passage through a condenser and an anhydrous calcium sulfate filter.

The sample flow as maintained between 0.5 and 1.0 liters per minute and was controlled by a calibrated rotameter.

The analyzer was set up on the 0-50 parts per million (ppm) CO range. The instrument was zeroed and spanned (span gas was analyzed and certified to be 80% of full scale - 39.6 ppm) daily, using a zero offset of 5% of full scale to account for negative zero drift. The sampling sequence was initiated with continuous sampling over a 24-hour sampling period. Upon completion of a sampling interval, zero and span gases were again passed through the analyzer. The zero and span were reset as necessary to correct for drift, and another sampling period was initiated.

(b) Meteorological Data. The meteorological tower was situated on the roof of Building #204. vane and meteorological sensors were located about 15 meters above ground level and 6 meters

above the roof. Data impulses were transmitted continually to a dual wind speed/wind direction strip chart recorder.

(3) Data Reduction Procedures. Reduction of the valid continuous monitoring data to 1-hour intervals was accomplished by the use of an electronic digitizing system. This system reads a number of data points from the strip charts upon which the data are originally recorded. These points are transmitted to a computer which summarizes them into hourly averages based on calibration factors and adjustment for instrument drift, if necessary. CO data were summarized as parts per million (ppm), and wind speed and wind direction as miles per hour and degrees, respectively. These data are tabulated in Appendix A.1.a in SAROAD format.

STATISTICAL ANALYSIS OF METEOROLOGICAL DATA

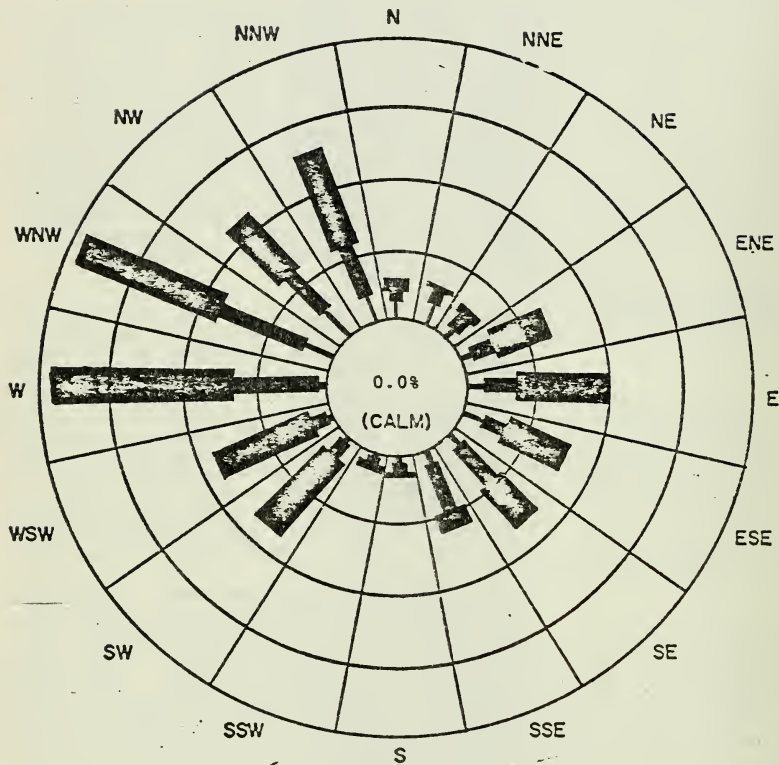
(1) Analytical Procedures. One-hour averages of wind speed and wind direction were determined from the output of a dual strip chart recorder, as described in the previous subsection. These data are summarized in the form of a wind rose, shown in Figure E-2, and are tabulated in EPA's SAROAD format in Appendix A.1. A wind rose spatially depicts the frequency of occurrence of wind speed from a particular direction. In Figure E-2, wind speed is subdivided into three classes (0.1-3.0, 3.1-6.0, and 6.1+ mph), with the lowest speed class shown on the inside of the rose.

(2) Interpretation of Wind Rose. The lowest class of wind speed shows a relatively even distribution across all compass points with the exception of the SW quadrant, where few instances of low winds occurred. The moderate and high wind speed classes are highly directionalized, occurring almost exclusively in the WNW and ESE quadrants. Strong winds from an easterly direction indicate the onset of local sea breeze circulation, while those from a westerly direction are associated with the prevailing WNW wind for the region.

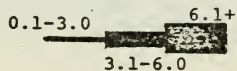
(3) Comparison of Measured Data with Historical Records. A survey of the meteorological data available in the vicinity of the project area indicates that the most comprehensive and readily available records are those of the National Weather Service Station in Boston, Massachusetts. This weather station is located

FIGURE E-2

WIND ROSE FOR CHARLESTOWN SITE



Wind Speed Legend, mph



approximately two miles east of the project site, at Boston's Logan International Airport. Surface wind data at the site, averaged over ten years (1951-1960), are presented in the wind rose shown in Figure E-3. These historical data indicate winter winds primarily from the NW and summer winds from the SW. Lack of specific correlation of these historical data with the measured wind data is due principally to the relatively short period of the monitoring program. Calm conditions, conducive to poor ventilation, occur at a frequency of about one percent, comparable to no measured calms at the monitoring site.

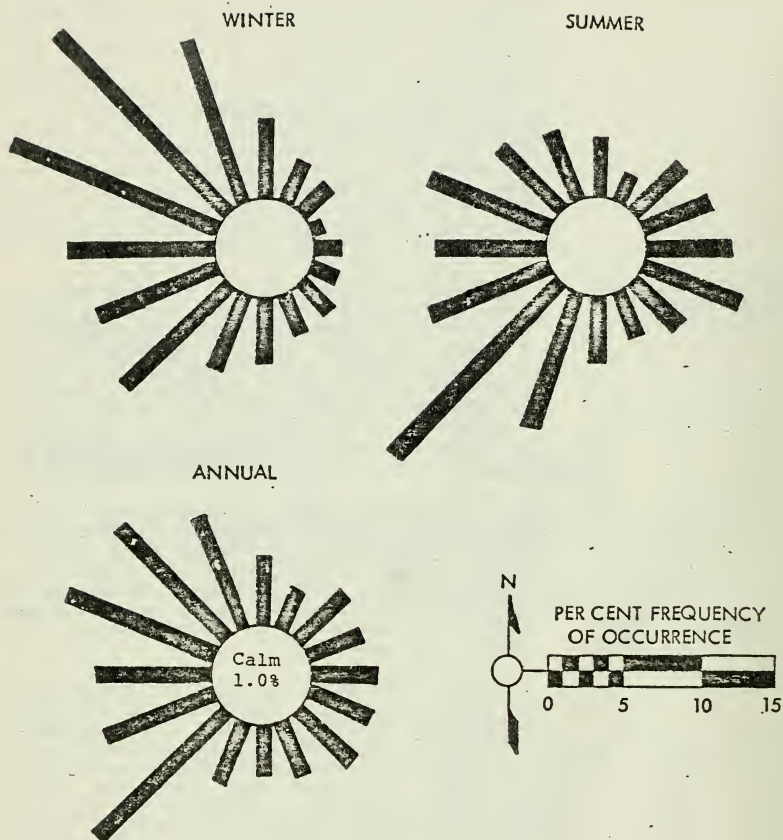
STATISTICAL ANALYSIS OF CARBON MONOXIDE DATA

(1) Analytical Procedures. The ambient air quality standards for carbon monoxide apply to two short-term averaging periods: 1 hour and 8 hours. Measured 1-hour concentrations were determined from the output of the strip chart recorder, as previously described. These data are tabulated in SAROAD format in Appendix A.1. Comparison of these hourly observations with the relevant Federal and State standards was accomplished by the following procedures:

For the 1-hour values, the measured data were ordered highest to lowest by concentration, and a cumulative frequency distribution was prepared on logarithmic probability paper, as shown in Figure E-4. This plot depicts the percentage of valid sampling time that a particular concentration of carbon monoxide was equalled or exceeded.

Two techniques were employed for computation of 8-hour averages. The first was a running 8-hour average for which the 1-hour carbon monoxide concentrations were arithmetically averaged over consecutive 8-hour periods, viz., 0000-0800, 0100-0900, 0200-1000, etc. The second method divided a 24-hour day into three discrete 8-hour averages: 0000-0800, 0800-1600, 1600-2400. The first technique yields 24 possible 8-hour values, while the second results in only three. Cumulative concentration frequency distributions were also prepared from these ordered 8-hour data and are shown in Figures E-5 and E-6.

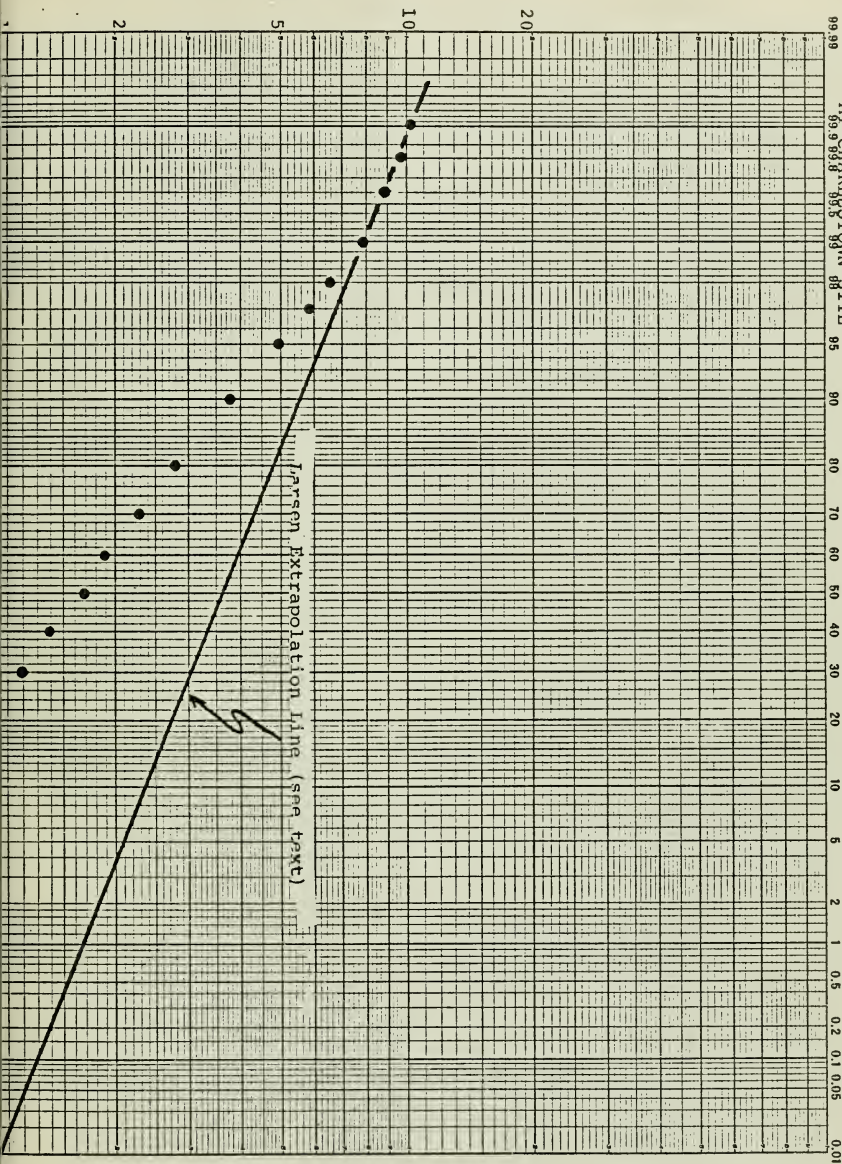
To assess the possible advection of carbon monoxide onto the monitoring location from "up-wind" sources, a pollution rose, spatially depicting the frequency of occurrence of distinct



WIND DIRECTION PER CENT FREQUENCY OF OCCURRENCE
FOR VARIOUS AVERAGING TIMES.

U.S. Weather Bureau Data for Logan International Airport, Boston,
Mass., 1951 through 1960.

FIGURE E-4
 CUMULATIVE FREQUENCY DISTRIBUTION FOR 1-HOUR AVERAGE CO CONCENTRATIONS
 AT CHARLESTON SITE
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Measured CO Concentrations (ppm)

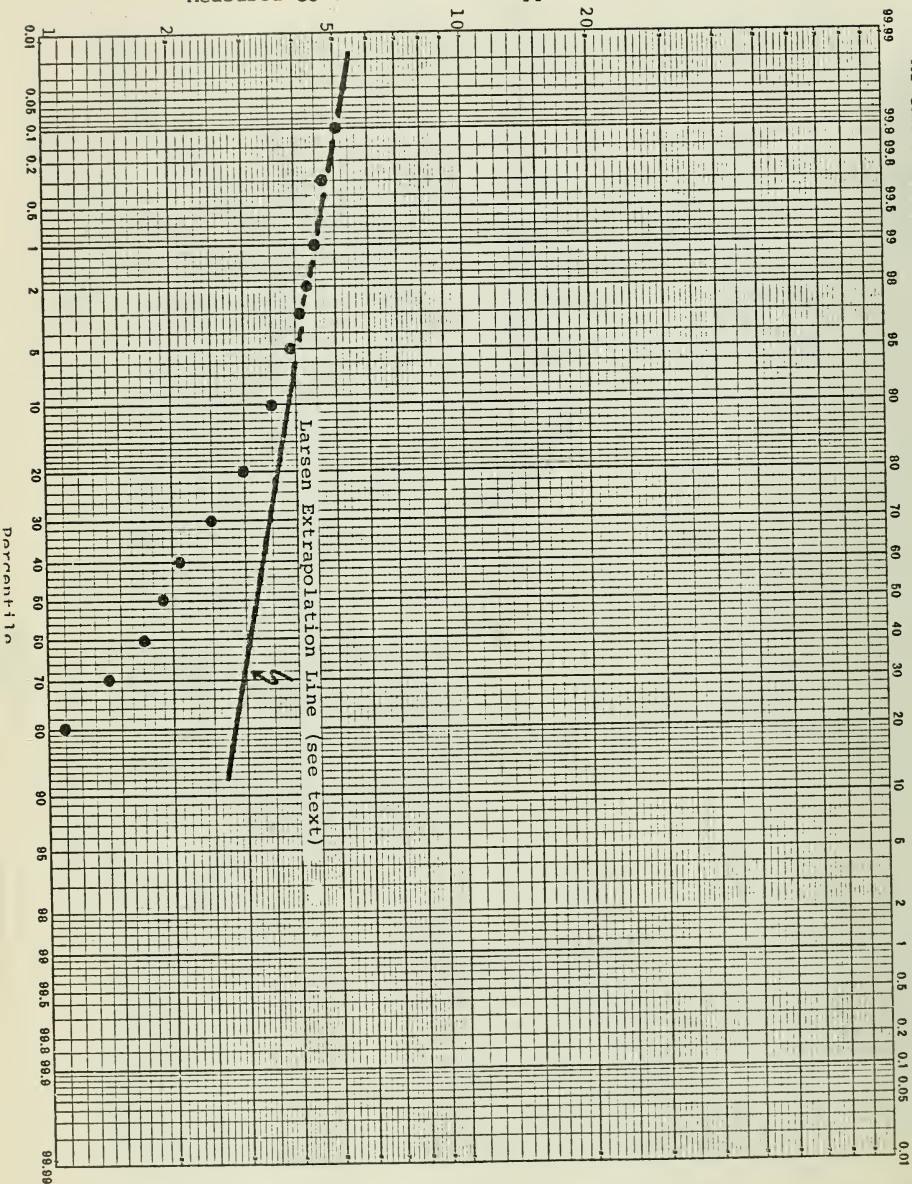
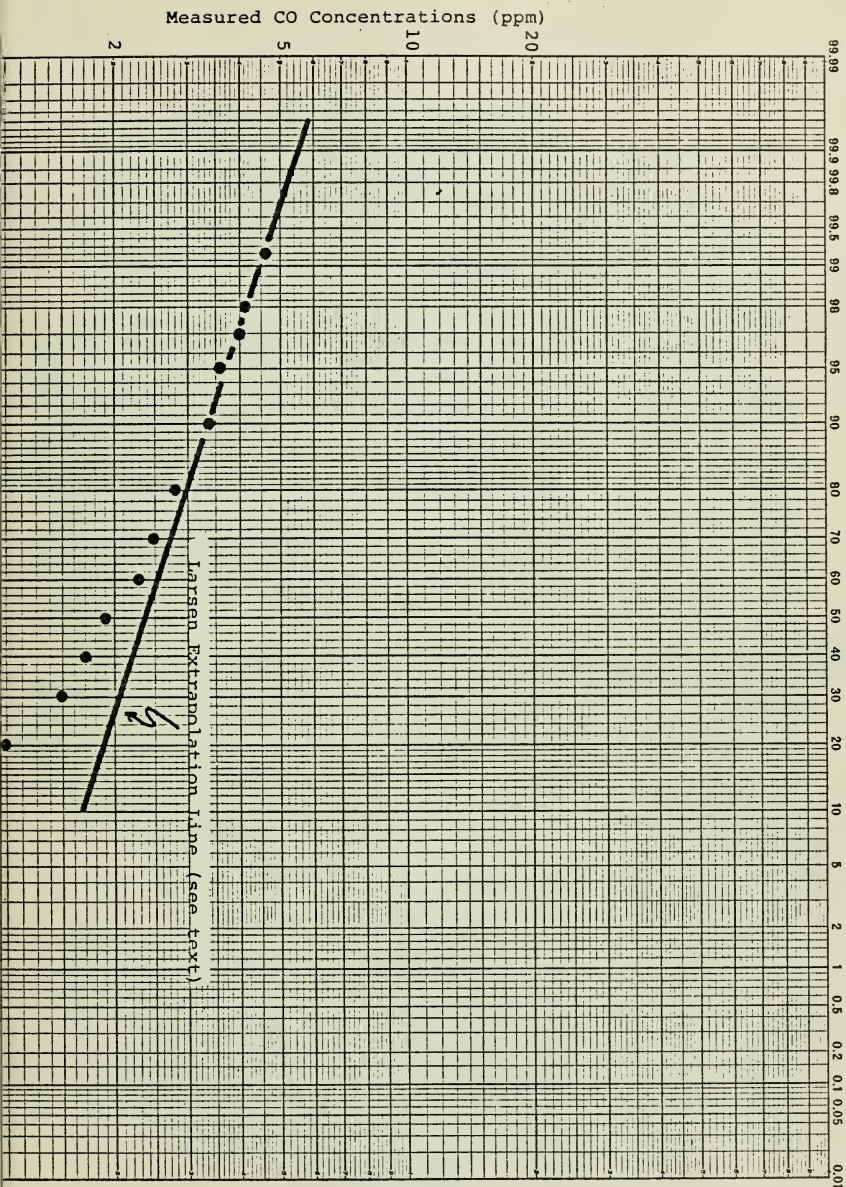


FIGURE E-6
 CUMULATIVE FREQUENCY DISTRIBUTION FOR DISCRETE 8-HOUR AVERAGE CO CONCENTRATIONS
 AT CHARLESTOWN SITE



levels of carbon monoxide concentrations from a particular compass direction, was prepared from the data. (See Figure E-7). The 1-hour carbon monoxide concentrations were categorized into three arbitrary classes (0-3, 3.1-6, and 6.1+ ppm). These data were distributed along the 16 major points of the compass, corresponding to the wind direction that occurred for the particular 1-hour concentration of interest.

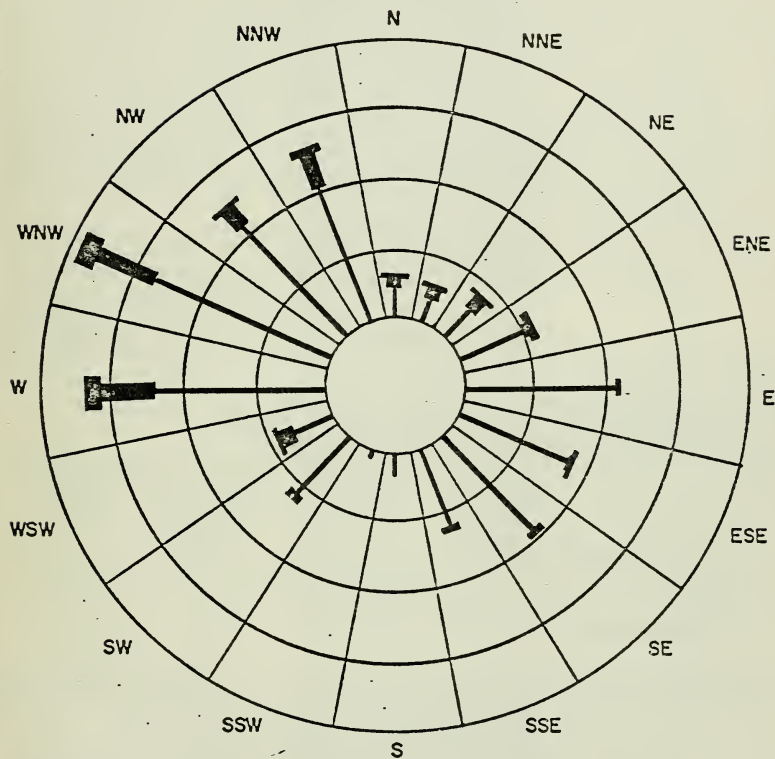
(2) Extrapolation/Comparison to Standards. There were no instances during the 60-day monitoring period where the 1-hour or 8-hour ambient air quality standards were exceeded. The maximum recorded levels of CO during the field program are summarized in Table E-7 . A qualitative assessment of the measured 1-hour CO concentrations at the Charlestown site reveals peak levels occurring, in general, between 0700 and 0900 and between 1530 and 1630, Monday through Friday. These time periods correspond to the morning and evening rush hours, during which traffic levels are highest on I-93 (Tobin Bridge), the major roadway nearest to the monitoring site.

TABLE E-7
MAXIMUM MEASURED CARBON MONOXIDE CONCENTRATIONS AT THE PROJECT AIR
QUALITY MONITORING SITE IN CHARLESTOWN, MASSACHUSETTS

Parameter	Maximum Measured Concentration (ppm)	Date/Time	NAAQS (ppm)
1-Hour Average	10.2	09/30/75-0800-0900*	35
Running 8-Hour Average	5.1	11/3/75-1300-2100	9
Discrete 8-Hour Average	4.6	11/3/75-1600-2400	9
* Eastern Daylight Time			

(a) Interpretation of Frequency Distributions. When cumulative concentration frequency distribution data can be correlated on logarithmic probability paper by a straight line, the data are classified as "lognormally distributed." Such a distribution provides a statistical basis for estimating annual maximum 1-hour and 8-hour concentrations at the measurement sites using Larsen's techniques [4,5]. This tool is extremely valuable for extrapolating air quality data for a relatively short-term measurement program

FIGURE E-7
CO POLLUTION ROSE FOR CHARLESTOWN SITE



CO Levels Legend, ppm



(e.g., 60 days) to concentrations which, statistically, could be expected to occur within longer time frames (a year). All three carbon monoxide frequency distributions exhibit satisfactory correlation to such a distribution on the high end of the distribution plots. The straight lines shown in Figures E-4 and

E-5 are drawn through the data points at the 0.1 and 1.0 percentile frequencies; that in Figure E-6 uses the 1.0 and 10.0 percentile frequencies, as suggested by Larsen [5]. In this way, the estimation of statistical parameters was based on the highest measured values

From each distribution plot, the geometric mean, standard geometric deviation, and estimated annual maximum concentration were calculated. These data are summarized in Table E-8. The results project no violations of either the 1-hour or 8-hour ambient CO air quality standards at the monitoring site.

TABLE E-8

STATISTICAL PARAMETERS FOR MEASURED CO CONCENTRATIONS AT PROJECT AIR QUALITY MONITORING SITE IN CHARLESTOWN, MASSACHUSETTS
(Calculated Using the Techniques of Larsen [5])

Parameter	Standard Geometric Deviation* (ppm)	Geometric Mean * (ppm)	Estimated 1975 Annual Maximum (ppm)	NAAQS (ppm)
1-Hour Average	1.40	3.63	13.0	35
Running 8-Hour Average	1.18	3.04	5.8	9
Discrete 8-Hour Average	1.34	2.79	7.0	9

(b) Interpretation of Pollution Rose. Low levels of CO (0-3 ppm) occurred with frequencies and directions coincident with those for high wind speeds at the monitoring site (see Figures E-2 and E-7). Low wind speeds are fairly evenly distributed over all compass points. However, moderate (3-6 ppm) and high (6+ ppm) CO concentrations occur primarily in the WNW quadrant. This implies that there is a significant source of CO from this direction. Indeed, the closest roadway, I-93 (Tobin Bridge), is located 40 feet to the WNW of the monitoring site.

* Comparison with State parameters was not possible since the comparable State data were not available.

(3) Comparison to State Data. Air quality measurements taken by the Commonwealth of Massachusetts, Bureau of Air Quality Control, during the past year are shown in Table E-5. Unfortunately, measurements for the 60-day monitoring period of this study were not available from the Commonwealth when this report was prepared. However, CO concentrations measured during the same time period in 1974 show higher levels in downtown Boston (Kenmore Square) than were measured in Charlestown (see Table E-7), due to greater traffic congestion (and hence lower average vehicle speeds) in the downtown area. Maximum measured 1-hour CO levels at Wellington Circle in September and October, 1974, (12 ppm) are close to those measured in this study in Charlestown (10.2 ppm), whereas maximum 8-hour CO levels at all three State sites during this time period (11.3, 8.6, and 7.9 ppm) were significantly above those measured in Charlestown (5.1 ppm).

AIR QUALITY MODELING ANALYSIS

The air quality modeling analysis evaluated the effect of the alternatives on pollutant concentrations in the project area. The analysis was performed on two levels: a macro-scale analysis which projected the total areal emissions of each pollutant for each strategy and a microscale analysis which determined expected pollutant concentrations at sensitive receptors in the area. The latter study was performed only for carbon monoxide, as hydrocarbon and nitrogen oxide concentrations are intimately related to complex atmospheric photochemical processes. These reactions are more of a regional phenomenon and are, therefore, not readily amenable to analysis of localized ambient air quality impact.

DESCRIPTION OF ATMOSPHERIC DIFFUSION MODEL

All predicted carbon monoxide (CO) concentrations for this study were determined using the APRAC-1A urban diffusion model developed at the Stanford Research Institute [6].* The model simulates CO concentrations from readily available meteorological and traffic data. It is based on the Gaussian plume configuration and incorporates results from several recent research studies [7, 8, 9]. Emission sources are specified in two forms: a primary network of traffic road segments or links and a secondary grid of area sources. The model calculates pollutant concentrations from diffusion on various scales, ranging from extraurban diffusion of sources in upwind cities to intraurban diffusion of freeway, arterial, and feeder street sources. In addition, a submodel handles

* The program was modified by Walden to allow representation of elevated sources.

the helical air circulation typical of street canyons. One-hour average CO concentrations are calculated as a function of time, for comparison and verification with observed concentrations and for operational applications.

The computer program VEHEMI, developed by Walden Research, was integrated into the model to determine more accurately vehicle CO emission rates. VEHEMI is designed to compute, using EPA methodology, the CO emission rate (grams CO/vehicle mile) for a specified motor vehicle model year mix--in this case, a mix typical of the Boston area--and allows for explicit input of the ratio of light- to heavy-duty vehicles. It replaces an older empirical equation in APRAC-1A that was previously used for this purpose. The method used is based on a procedure outlined by Kircher and Armstrong [10] and incorporates such considerations as deterioration and speed adjustment factors. Also, recent changes in the Federal automobile emission standards related to amendments to the Clean Air Act of 1970 have been incorporated into VEHEMI [11].

METEOROLOGICAL FACTORS

It is generally agreed that the meteorological factors directly involved in predicting pollutant concentrations are transport and dilution by the mean wind and dispersal by atmospheric turbulence [12]. These meteorological parameters exhibit important time and space variations, particularly in the lower several thousand feet, where air pollution problems are most acute. The character of the variations in these properties is, in turn, strongly related to the vertical thermal structure of the atmosphere in this boundary layer. During conditions of an unstable atmospheric thermal structure, both horizontal and vertical dispersion of pollutants is enhanced, whereas in stable atmospheres, the reverse conditions apply. Consequently, the thermal stability of the ambient air is an important controlling factor in determining the dispersion properties in a given region.

Another important meteorological parameter is the mixing depth, the vertical thickness of the atmospheric layer in which turbulent mixing can diffuse the emissions. Deeper mixing depths will permit the pollutant to be dispersed into larger volumes, resulting in lower ground-level concentrations. Under certain

meteorological conditions, principally low-level temperature inversions, this thickness can be severely limited--thereby trapping the pollutants within a shallow layer near the ground. The mixing depth within a region generally varies both with the season and with the time of day.

Thus, the dispersion properties of the atmosphere at any particular time can be described in terms of the joint occurrence of specific conditions of thermal stability, mixing depth, and wind. These meteorological factors are highly interrelated and are observed to occur in combinations of different conditions with varying frequency.

The APRAC-1A urban diffusion model used in this study to model air quality impacts is designed to be generally applicable to any city where conventional airport weather observations are taken. Airport surface wind speed and direction can be used directly. Special methods [6] were developed to calculate the mixing depth and stability index from the available meteorological observations. The method used for the mixing depth calculation is based on the National Weather Service's 1200 GMT upper air temperature sounding. This sounding, together with the maximum afternoon temperature at the surface, permits the afternoon or maximum mixing depth to be calculated. The morning or minimum mixing depth is calculated by using a simple urban model and an empirical relationship involving city size and urban and rural nighttime temperatures. Hourly mixing depths are then interpolated on the basis of the observed hourly surface temperatures for the daylight and pre-midnight hours; mixing depth is assumed to be constant between the hours of midnight and dawn. The method used to determine the stability index depends on prevailing solar insolation and wind speed during daylight hours and on cloud opaqueness and wind speed during nighttime hours.

TRAFFIC DATA BASE

The urban diffusion model used in this study requires a traffic data base structured on two levels. First, a high-resolution primary network of road segments or links is specified. Input parameters are the location, length, level of service, and average daily traffic (ADT) for each link. Second, a grid of area sources to handle traffic emissions which do

not require a high spatial resolution is defined. Input here consists of the area and location of the grid squares and the 24-hour vehicle miles traveled (VMT) within each square

As part of a program to develop a Metropolitan Boston Transportation Control Plan (MBTCP), transportation data were gathered for Boston and the environs included within circumferential Route 128. The region was divided into three areas corresponding to the inner city and the inner and outer suburbs (see Figures E-8 and E-9). A grid was superimposed upon each of these three areas so that each grid cell contained a uniform density of traffic activities. Thus, the size of the grid used in each area was a function of urban densities and activity concentrations.

(1) Validation Data. The MBTCP study categorizes 1971 and projected 1977 daily VMT for each grid cell in the Metropolitan Boston area by facility type (freeway, arterial, collector, and local). By interpolating, 1975 daily VMT data were developed for input as the secondary grid of area sources in the model. The primary grid network (see Figure E-10) was supplied by Wallace, Floyd, Ellenzweig, and Moore, Inc. (WFEM), and was based on 1975 actual peak-hour traffic counts conducted during a typical weekday in Charlestown. These data represented approximately 60 percent of the total daily surface VMT in the Charlestown area as estimated from the MBTCP. Traffic counts on the Tobin Bridge and Lowney Way were provided by the Boston Redevelopment Authority and collected concurrently with the air quality monitoring program.

(2) Impact Analysis Data. Projections of total VMT in the Charlestown vicinity for three design years, 1976, 1985, and 1995, were constructed from BTCP data [2]. The 1976 data resulted from interpolation between 1971 and 1977 (uncontrolled) VMT data for each grid. The 1985 and 1995 data resulted from applying BTCP growth factors to the 1977 (controlled) VMT estimates.

Estimates of total peak-hour traffic demand were developed by the traffic consultant and provided to Walden by WFEM for each link of the primary network. Data were provided for

BOSTON AIR QUALITY STUDY
GRID CELL CONFIGURATION

INNER CITY AREA

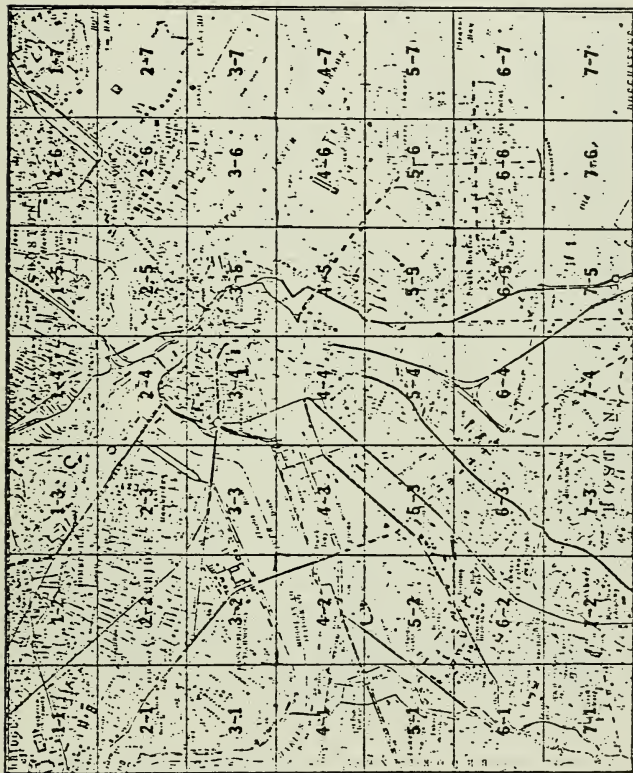


FIGURE E-8

BOSTON AIR QUALITY STUDY GRID CELL CONFIGURATION

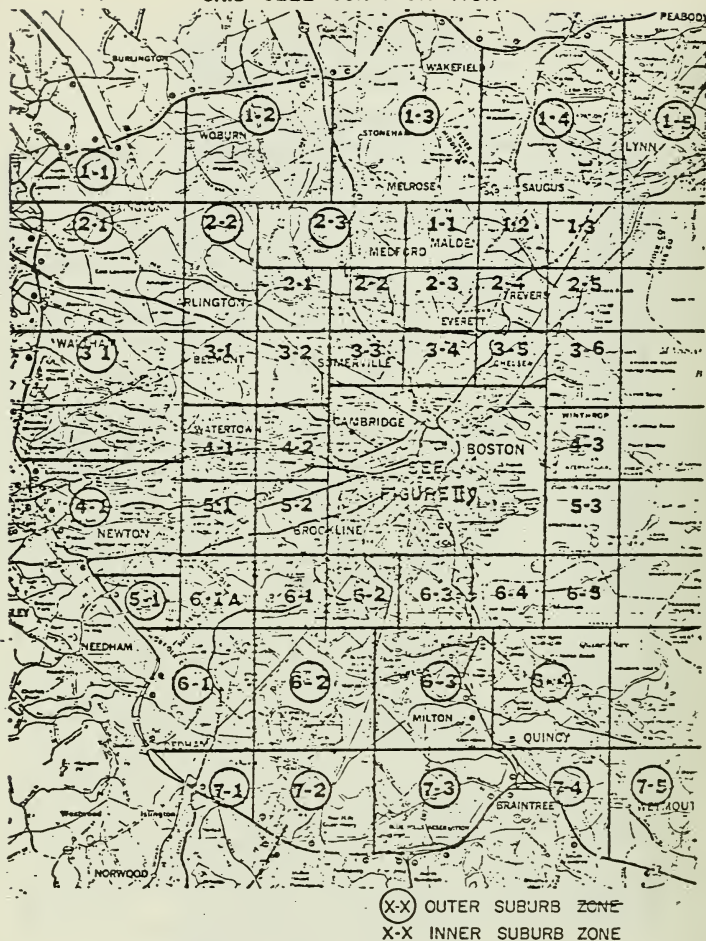


FIGURE E-9

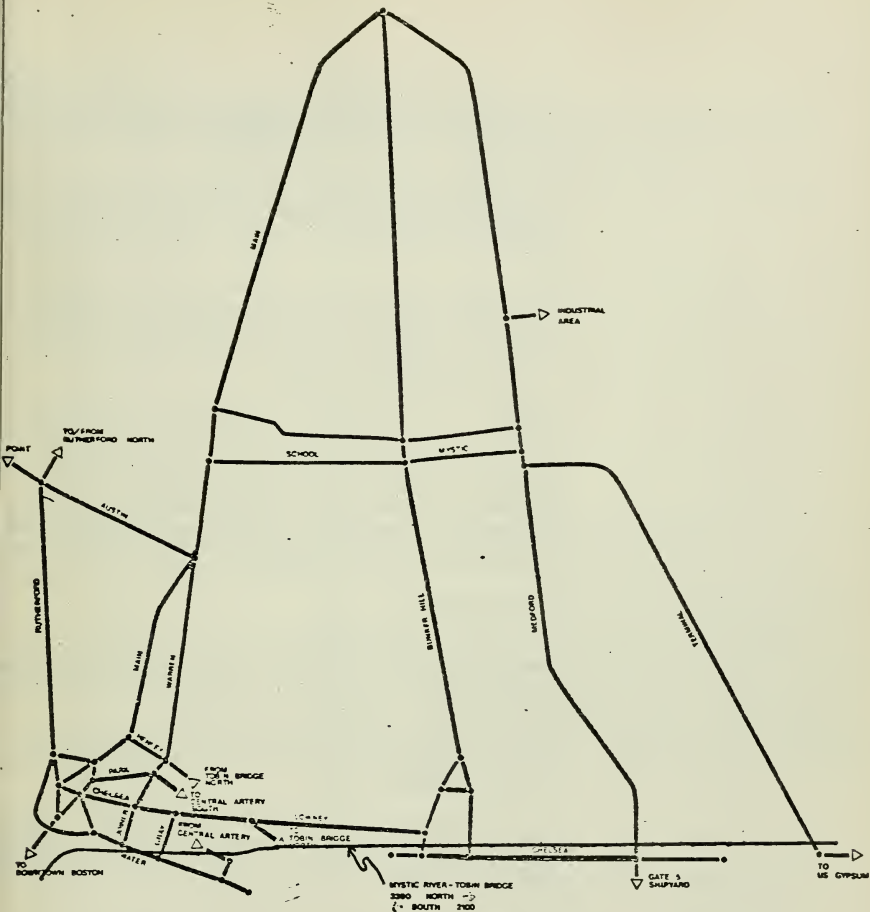


FIGURE E-10
PRIMARY LINK NETWORK

Chelsea-Water Street Connector
Little Mystic Channel Crossing
Draft Environmental Impact Statement



the following cases:

- 1) Traffic volume and average vehicle speed in 1976, 1985, and 1995, assuming the project is not built (the No-Build Case)
- 2) Traffic volume and average vehicle speed in 1976, 1985, and 1995 for each alternative, assuming the project is built (Build-Projection A)
- 3) Traffic volume and average vehicle speed in 1985 and 1995 for each alternative, assuming that the project is built and that a major tourist attraction is located within the Navy Yard (Build-Projection B).

Table E-9 presents a schematic of the cases evaluated in the impact analysis. The build alternatives (2, 2A, 3, and 4) each assume connection of Chelsea and Water Streets and a bridge over the Little Mystic Channel. The differences among the alternatives are the methods of connecting Chelsea and Water Streets. A brief description of this connection for each alternative is as follows:

1) No-Build

2) North- and south-bound lanes of the connector are separate. Water Street off-ramp passes under south-bound lane, joining north-bound and providing no south-bound movement.

2A) North-bound and south-bound lanes are the same as in 2. Off-ramp provides both north and south movements.

3) The connecting lanes are in a tunnel. The off-ramp passes over the portal, makes a full circle, and provides north and south turns on the connection.

4) The connecting lanes are not separated and are at grade. The Water Street off-ramp north-bound enters the connector at a traffic signal. Water Street off-ramp south-bound merges with the connector.

A complete description of each alternative is included elsewhere in the DEIS.

Both projection schemes (A and B) assume that use of the Navy Yard and the Moran Terminal

TABLE E-9
CASES EVALUATED IN IMPACT ANALYSIS

Year	No-Build	Build Alternatives			
		2	2A	3	4
<u>Traffic Projection A</u>					
1976	✓	✓	✓	✓	✓
1985	✓	✓	✓	✓	✓
1995	✓	✓	✓	✓	✓
<u>Traffic Projection B</u>					
1976*					
1985		✓	✓	✓	✓
1995		✓	✓	✓	✓

* Implementation of the community development plans reflected by Traffic Projection B is not expected to occur before 1977.

will expand. As these are demand projections, the projected VMT among the various build alternatives (2, 2A, 3, and 4) is constant. Table E-10 presents projected total VMT for the primary link network for each of the projection schemes and design years noted above. Average vehicle speed, average ratio of light-to heavy-duty vehicles, and ratio of 1-hour to 8-hour traffic were provided for each link and case by WFEM.

TABLE E-10
TOTAL DAILY VEHICLE MILES TRAVELED (VMT), PROJECT AREA PRIMARY LINK NETWORK

Year	No-Build	Build Projection A*	Build Projection B*
1976	52,720	50,330	—
1985	54,370	51,450	53,510
1995	70,010	66,900	68,163

* Total VMT among the various build alternatives (2, 2A, 3, and 4) are identical within a given projection scheme and design year.

The secondary grid VMTs by grid were estimated by subtracting primary link VMT from total VMT in the grids containing Charlestown. Other grids were not affected by this procedure. No attempt was made to adjust total VMT in the grid area due to changes between the build and no-build options because the primary link VMT represents only about 2 percent of the total VMT in Metropolitan Boston, and variations in VMT due to the options represent only 2-5 percent of the primary network.

MODEL VALIDATION

For the purpose of verifying the accuracy of the diffusion model in predicting CO concentrations for the project area, a model validation exercise was performed. This entails modeling the region for CO concentrations during several time periods for which on-site CO, traffic, and meteorological measurements are available, comparing the results statistically, and drawing conclusions.

As described in an earlier subsection, the monitoring of CO levels was undertaken during the period September 4, 1975, through November 4, 1975, at a location prejudged to experience potentially the greatest air quality impact as a consequence of the project. In addition, hourly measurements of wind direction and wind speed were taken on-site during this same time period. In conjunction with the data collection, actual hourly traffic counts were recorded on each level of the Tobin Bridge and Lowney Way. A typical hourly mix of light-duty and heavy-duty vehicles on the Tobin Bridge was supplied by the BRA. These data were used to specify the hourly percentage to be applied to the ADT on every link in the model. No vehicle speed measurements were made for this study. Instead, the estimated average speed for each link in the primary network was supplied by the traffic consultant. Estimates of average traffic speeds for Metropolitan Boston by grid cell and facility type for the secondary grid network were prepared from data in a BTCP report [2]. By assimilating on-site measurements of traffic, CO concentrations, wind speed and direction, along with other meteorological data (surface temperatures, cloud cover) from the National Weather Service (NWS) station at Boston's Logan Airport, a set of one-hour periods was selected for use in validation of the model. Since upper air soundings at Boston were discontinued by the NWS, it was necessary to use data from Portland, Maine. Both cities experience similar mixing height characteristics on a given day; consequently, the substitution will not affect the validation results significantly.

Analysis of the recoverability of each of the data elements indicated that three days existed for which all parameters were valid for every hour of the day. Of these, two days (48 1-hour periods) were selected at random for use in the

validation process. Included in this data set were periods during which large shifts in wind direction took place, such as might be associated with a frontal passage or the onset of a local sea breeze circulation. Also included were periods of very light winds during which the direction of the wind is highly variable. During meteorological conditions such as these, a Gaussian diffusion model (such as APRAC-1A) based on the assumption of an hourly mean wind speed and direction could be expected to perform poorly.

To evaluate the validation results, a correlation coefficient "r" was computed for the 48 1-hour periods. The correlation coefficient is a measure of the strength of a linear relationship between two variables, in this case the measured and predicted concentrations. It will have a value close to 0 for a line incapable of prediction and close to 1 for a line capable of perfect prediction [13]. The data gave a value of $r = 0.77$, a statistically significant result. This value may also be interpreted quantitatively by stating [13] that r^2 is equal to the percentage of the variance of the predicted concentrations that can be accounted for by a linear relationship with the measured concentrations (59%). The remaining percentage (41%) is referred to as the error variance, due to other factors, including

- Accuracy of the atmospheric diffusion model
- Variability of the micrometeorology
- Accuracy of the traffic volume data
- Errors in measuring CO levels and meteorological parameters
- Potential bias in representative sample used for validation

From this analysis, it is concluded that the predictions of the APRAC-1A model provide an acceptable correlation with CO data measured in the project area.

MODEL CALIBRATION

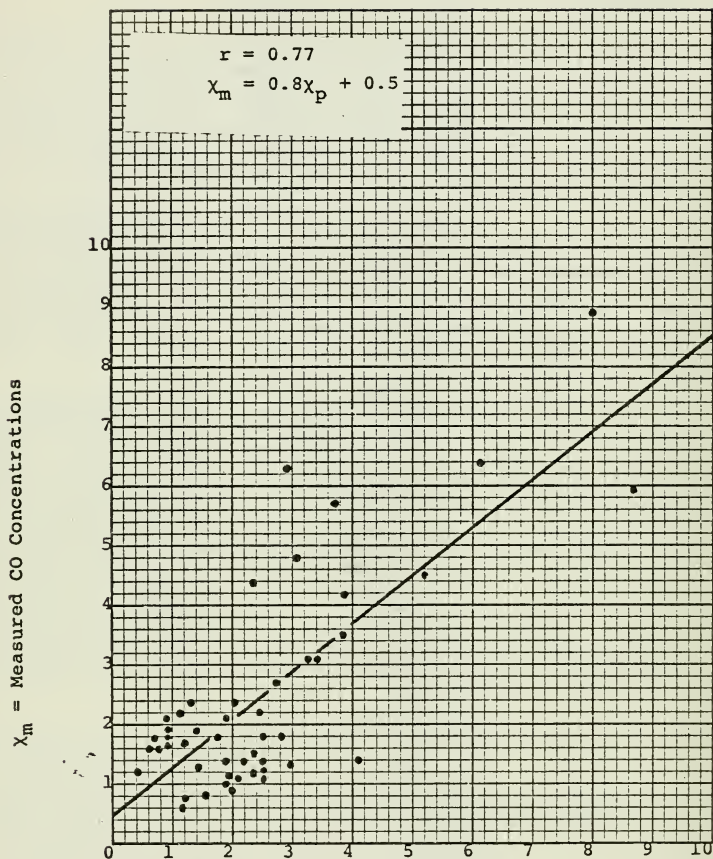
1-Hour Concentrations. The purpose of a calibration is to incorporate into the impact modeling program information concerning the relationship between measured (x_m) and predicted (x_p) CO concentrations uncovered by the model validation. This is accomplished by fitting the validation results to a straight line whose slope and intercept are then used as correction factors in making future predictions.

The scatter diagram depicting the relationship between x_m and x_p in the validation study is shown in Figure VII-11. By the method of least squares, the linear regression of x_m on x_p was found to be $x_m = 0.80 x_p + 0.50$ (solid line in Figure E-11). This equation was used to calibrate the model for the actual impact modeling program.

The results of this calibration indicate that the model generally tends to overpredict concentrations. This is consistent with the traffic volume data used in the analysis. That is, traffic on roads other than the Tobin Bridge and Lowney Way was estimated as the "peak demand" load rather than the results of actual traffic counts. Use of demand traffic counts would naturally lead to overprediction by the model. This is reflected in the calibration curve as a multiplier of less than one (0.80). The additive term of the curve (0.50) can be interpreted as reflecting background CO levels resulting from sources of CO not included in the traffic data, such as Logan International Airport.

Note that development of a model calibration based on a single geographic calibration point for application to model concentrations at other locations and in different time frames is recognized as being a questionable procedure [14]. However, the methodology for this procedure was developed in collaboration with EPA personnel [15] and was deemed an acceptable solution within the resources of the project. The consistency in development of traffic data for each alternative and time frame (all traffic data used in the impact analysis are "demand" loads) and use of constant meteorological conditions (as described in the following section) to evaluate each case will certainly result in an accurate analysis of the relative effects of each alternative. Furthermore, the use of worst-case meteorology and demand traffic

FIGURE E-11



χ_p = Predicted CO Concentrations

Comparison of Measured vs. Predicted 1-Hour CO Concentrations on Friday, October 10, 1975, and Wednesday, October 15, 1975

loads should result in considerable conservatism in the absolute predictions of air quality generated for assessment of the potentials for exceedance of air quality standards in the project area.

8-Hour Concentrations. Estimation of the maximum 8-hour CO concentration expected to occur from each case was calculated from maximum 1-hour concentrations [16]. A scaling or persistence factor, p , is determined from on-site measured CO data and the following equation:

$$p = \frac{\text{Max. 8-hour average concentration}}{\text{Max. 1-hour concentration with wind speed} < 2 \text{ m/sec}} \left(\frac{v_1}{v_8} \right)$$

where p = 1 to 8 hour persistence factor, dimensionless

v_1 = traffic volume demand in both directions during the hour in which highest CO concentrations were observed, vph

v_8 = average hourly traffic volume demand in both directions during the 8-hour period in which the highest 8-hour running average CO concentration is observed, vph

This procedure is performed for each day which satisfies the low wind speed criterion noted in the equation. From the values of " p " computed for each day, the highest value is assumed to be the design persistence factor. This value is used to scale all 1-hour concentrations to 8-hour values.

Analysis of data collected at the project site resulted in values of " p " consistently in the range of 0.54 to 0.57. A value of 0.57 was used to estimate 8-hour CO concentrations in the project area.

RESULTS

(1) Macroscale Analysis of Emissions. The quantity of each pollutant released from motor vehicles in the project area for each case was estimated by the computer program VEHEMI, which applies the most recent EPA motor vehicle emission factors [11] to the projected traffic volumes on project area roadways. The emission factors for carbon monoxide used in these computations are shown in Table E-11, distributed by calendar year and average vehicle speed. Emission factors for hydrocarbons and nitrogen oxides exhibit trends similar to those for CO. These factors reflect vehicle mix by model year, weighted travel by age of vehicle, deterioration of control devices as a function of model year and age, the split between light- and heavy-duty vehicles* on each roadway, and the effect of the BTCP's proposed semi-annual emissions inspection/maintenance program.

Estimates of total vehicular emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from the primary grid network were prepared for the four alternatives and for each of the configurations: No-Build (1976, 1985, 1995), Build Projection A (1976, 1985, 1995), and Build Projection B (1985, 1995).** No attempt was made to incorporate emissions from the secondary grid network, as this was based on a general study of the Boston area and uses areawide averages of VMT growth rate and vehicle speed. These data would tend to obscure the detailed changes resulting from the various options which are incorporated into the primary network

TABLE E-11

EMISSION FACTORS FOR CARBON MONOXIDE (IN GRAMS/VEHICLE MILE) FOR CALENDAR YEARS 1975, 1976, 1985, AND 1995 IN METROPOLITAN BOSTON, DISTRIBUTED BY AVERAGE VEHICLE SPEED AND PERCENT HEAVY-DUTY VEHICLES (HDV)

Calendar Year	Vehicle Speed and Percent Heavy-Duty Vehicles						
	25 mph 1% HDV	25 mph 12% HDV	20 mph 3% HDV	20 mph 8% HDV	16 mph 5% HDV	10 mph 8% HDV	6 mph 5% HDV
1975	34.6	46.1	45.7	52.3	59.1	89.6	100.0
1976	29.5	41.6	39.8	46.7	52.2	80.8	94.0
1985	5.0	21.8	10.2	19.9	17.4	35.2	33.0
1995	3.7	21.5	8.8	19.1	16.0	33.7	29.0

* Light-duty vehicles are rated at 6000 lbs. or less; heavy-duty vehicles exceed 6000 lbs.

** A description of each of the configurations presented in the section "Impact Analysis Data" above.

Analysis of the motor vehicle emission factors indicates a sharp decrease in emissions from calendar year 1975 to 1976, 1985, and 1995. This decrease results from several factors:

- The shift of the vehicle population to newer models will replace the oldest (uncontrolled) segment in the model year mix by newer models (controlled). As an example, CO emissions for these controlled vehicles are approximately 96 percent less than those for uncontrolled vehicles.
- The implementation of the BTCP's emissions inspection/maintenance program for all light- and medium-duty vehicles is expected to reduce all light-duty vehicle CO emissions by 9 percent and HC emissions by 10 percent [2].

Table E-12 presents the total annual emissions of carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NO_x) for the various configurations and alternatives. The results for alternatives 2, 2A, and 3 are identical and are presented in Table E-12 ; the expected vehicle load and average speed for each road in the link network are identical for these alternatives. Lower average vehicle speeds are expected on certain roads as a result of Alternative 4 implementation; therefore, a separate emissions analysis was performed for this case. The results of this alternative are also presented in Table E-12 .

The emissions data indicate that total emissions for all alternatives will decrease significantly between 1976 and 1985, due to the effects of Federal and BTCP emission controls. Emissions from 1985 to 1995 will increase because of the expected increase in total vehicle-miles traveled. Comparison of each of the build projections with the no-build projection for similar time frames indicates that the total emissions from all build alternatives will be less than or equal to emissions for the no-build case. This results for two reasons:

- Better flow of traffic results in higher average speed on each link.
- The improvement in the transportation system results in fewer vehicle miles traveled in the project vicinity.

TABLE E-12
TOTAL EMISSION OF CARBON MONOXIDE, HYDROCARBONS, AND NITROGEN OXIDES FROM PRIMARY LINK NETWORK (100 Tons/year)

Pollutant	No-Build Projection		Build Projection A		Build Projection B	
	1976	1985	1976	1985	1976	1985
CO	10.5	4.5	6.3	4.0	5.0	4.1
HC	1.3	0.5	0.7	0.5	0.6	0.6
NO _x	1.0	0.4	0.5	0.4	0.5	0.5
<u>Alternatives 2, 2A, and 3</u>						
CO	10.5	4.5	6.3	4.0	5.4	4.1
HC	1.3	0.5	0.7	0.5	0.6	0.5
NO _x	1.0	0.4	0.5	0.4	0.5	0.5
<u>Alternative 4</u>						
CO	10.5	4.5	6.3	4.0	5.4	4.1
HC	1.3	0.5	0.7	0.5	0.6	0.5
NO _x	1.0	0.4	0.5	0.4	0.5	0.5

* Not applicable; assumptions of projection will not be implemented before 1977

comparison among the various build alternatives indicates no significant difference in emissions in 1976 or 1985. In 1995, the emissions of Alternative 4 vary in proportion to the number of vehicles on the links. Calculations are based on volumes associated with full redevelopment of the northern Shipyard; in this case total 1995 emissions are approximately 8% greater with Alternative 4 than with Alternatives 2, 2A or 3. If, however, the capacity constraint of Alternative 4 inhibits full Shipyard redevelopment - as anticipated - then total emissions will be somewhat lower.

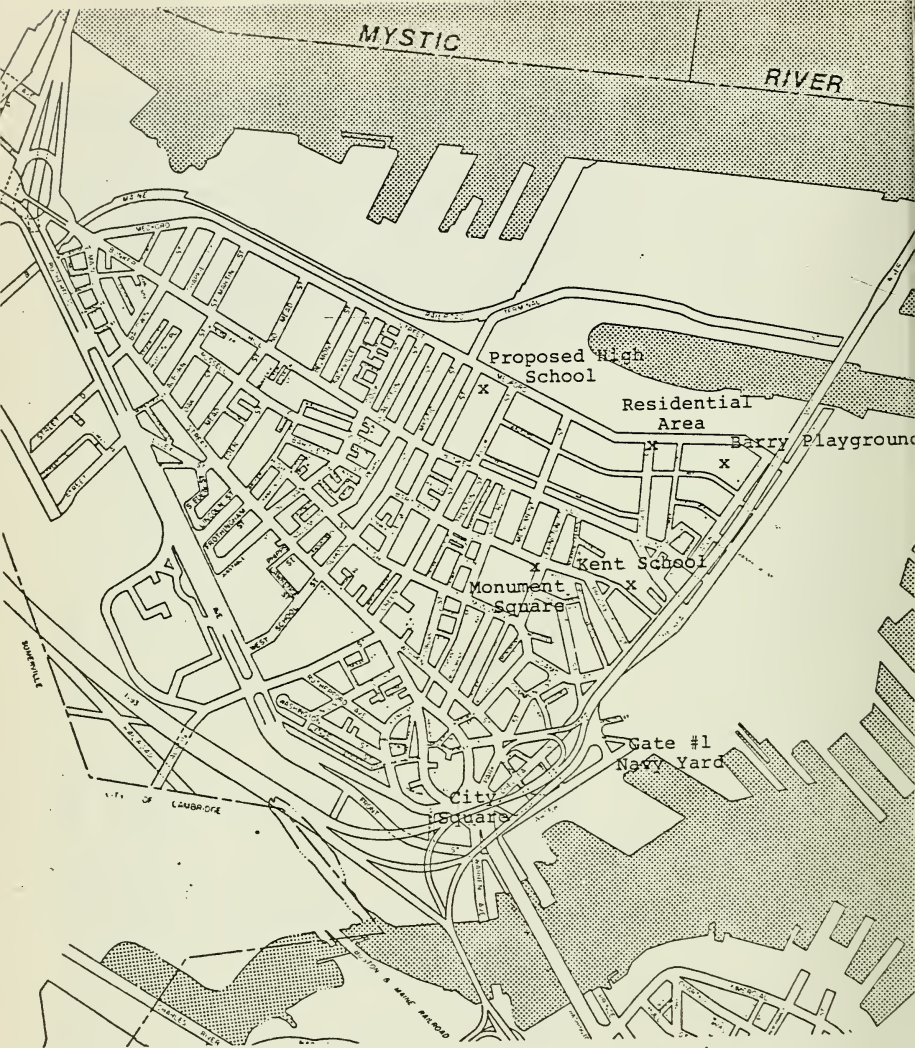


FIGURE E-12
RECEPTOR SITES

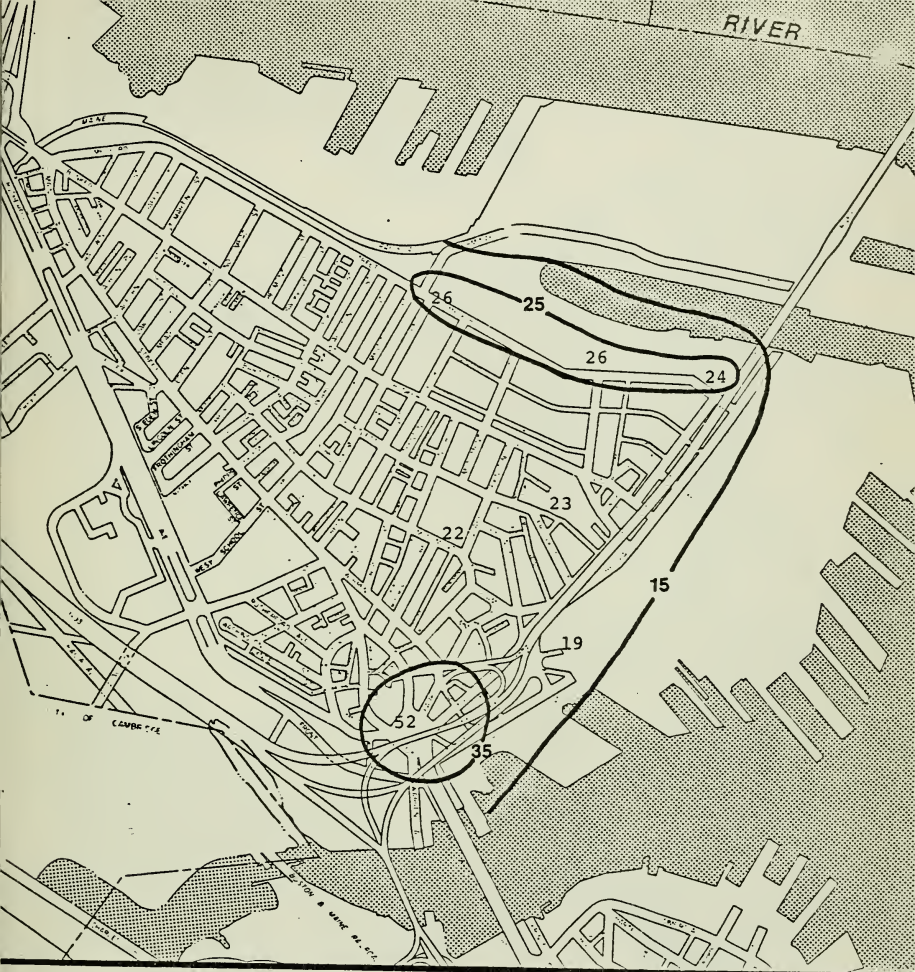


FIGURE E-13
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1976
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



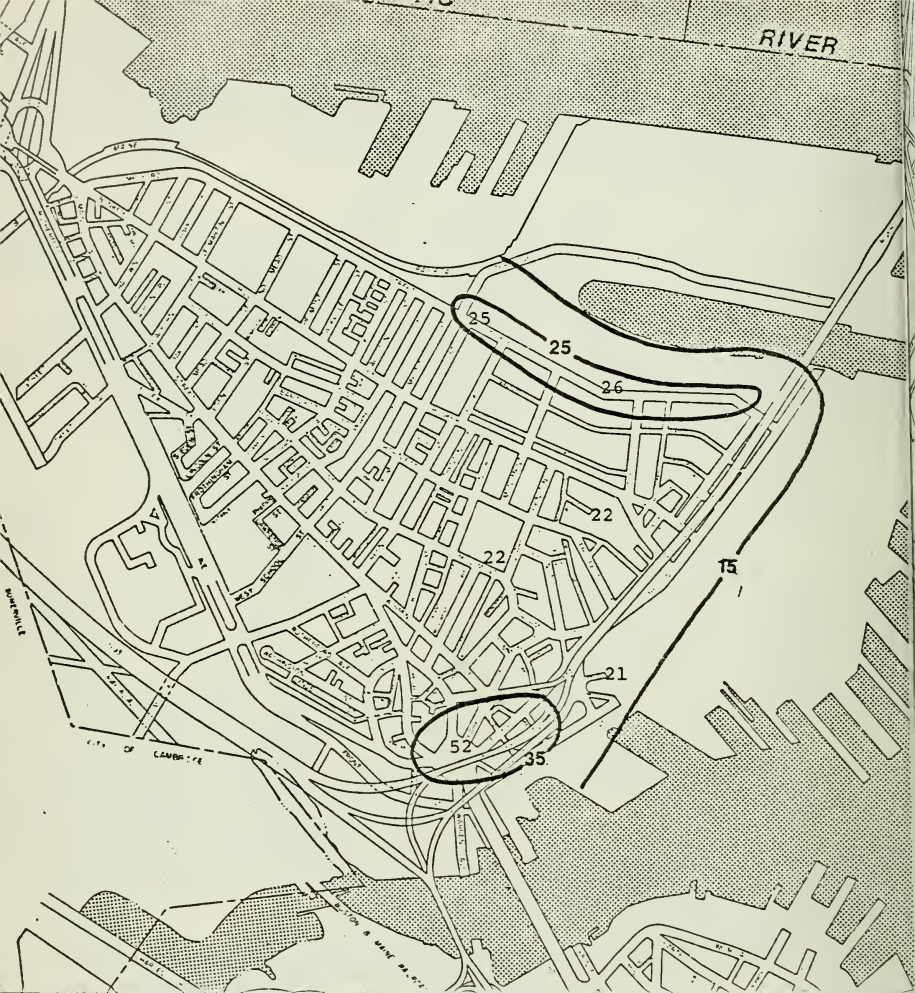


FIGURE E-14
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1976
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



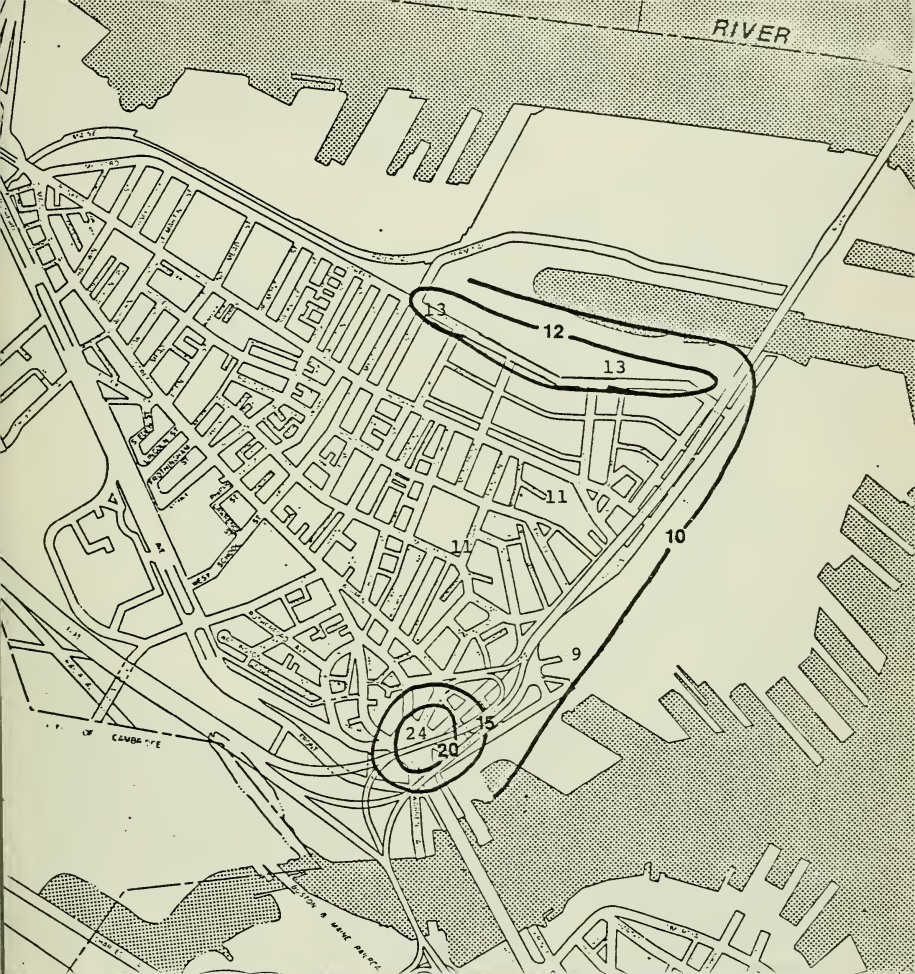


FIGURE E-15
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement





FIGURE E-16
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



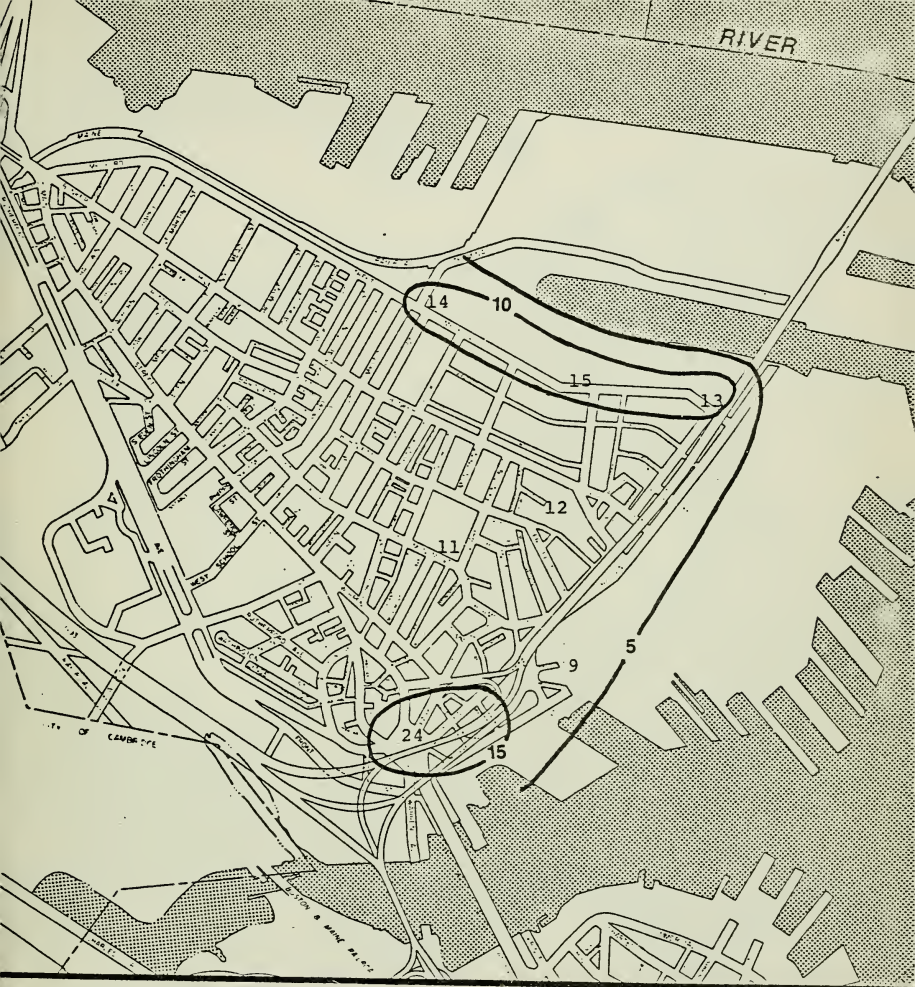


FIGURE E-17
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



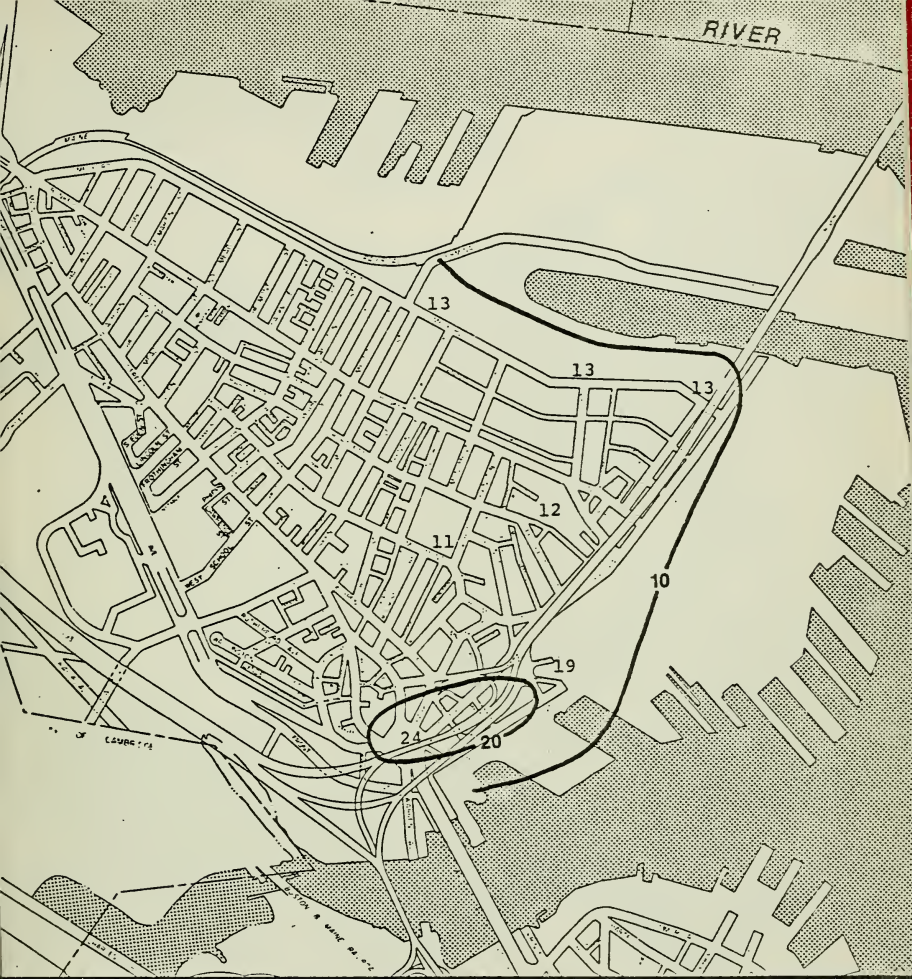


FIGURE E-19
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



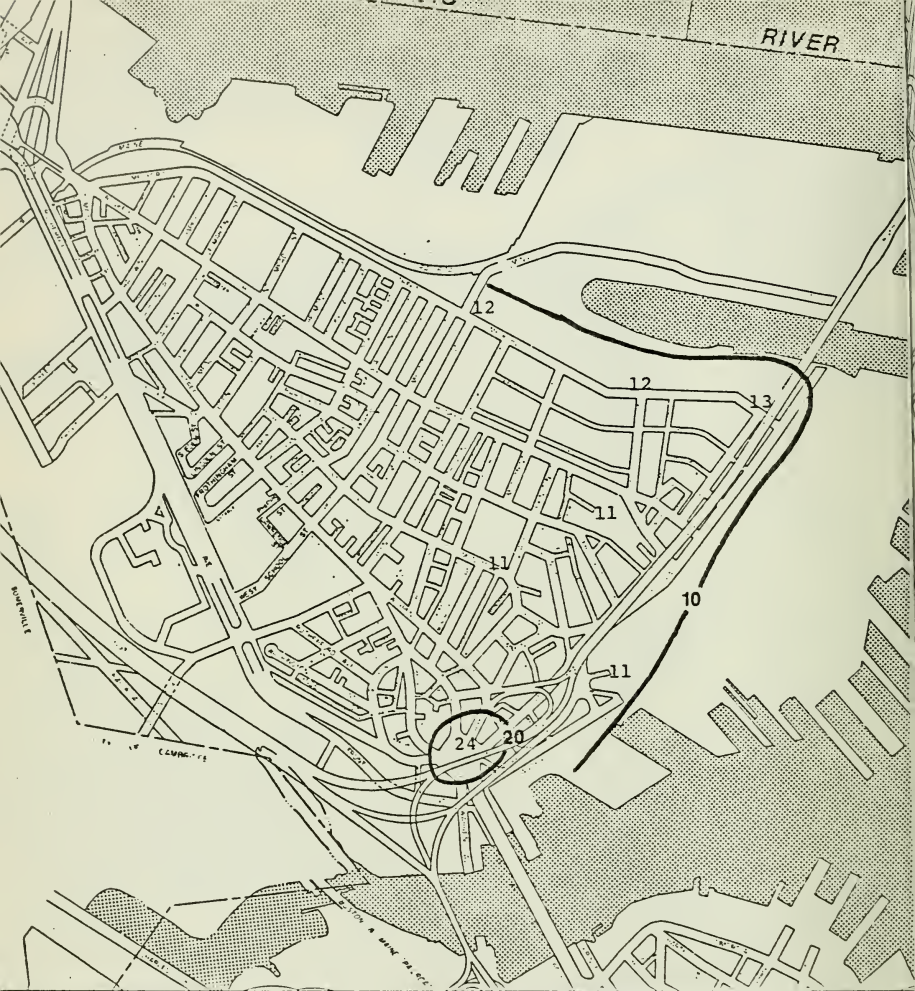


FIGURE E-20
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



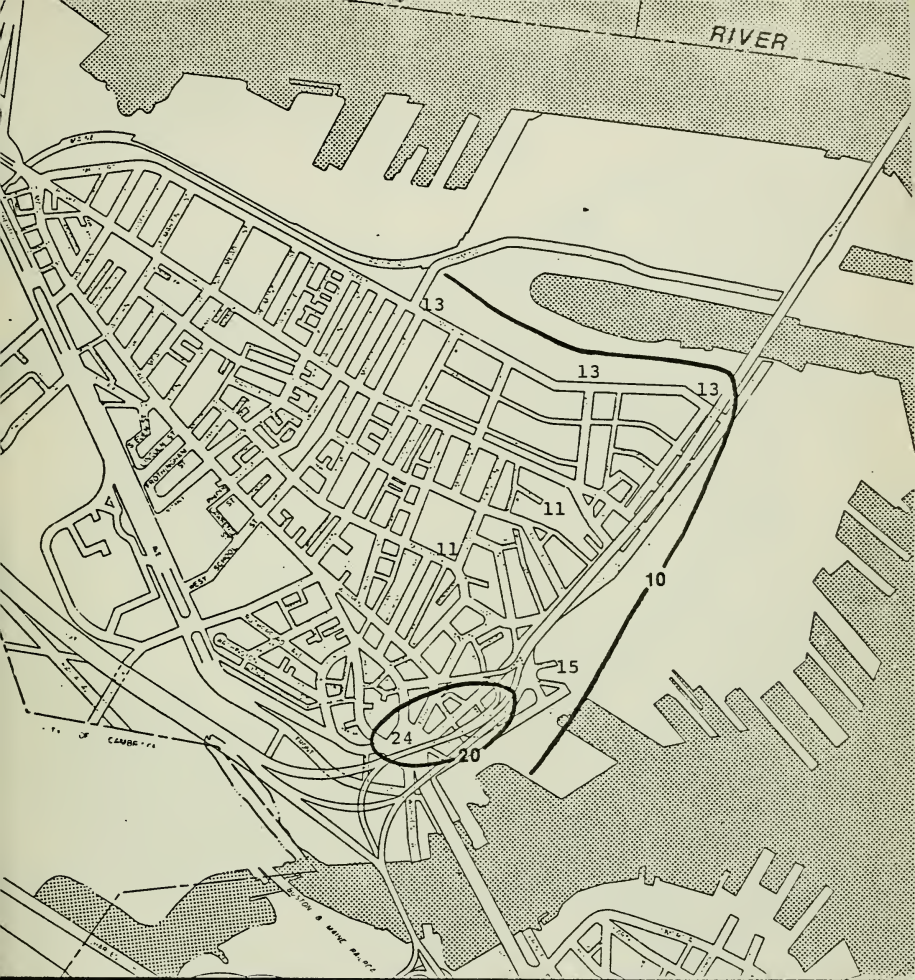


FIGURE E-21
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVES 2, 2A, 3

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



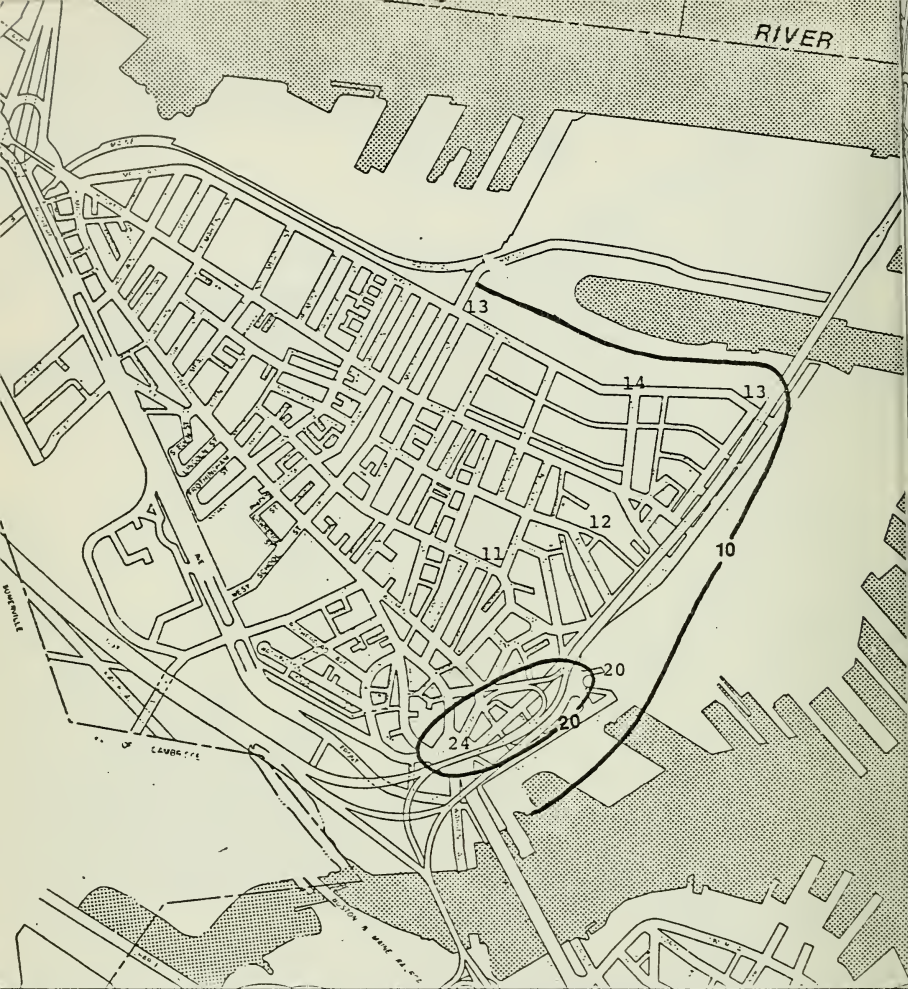


FIGURE E-22
 WORST CASE ONE-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVE 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



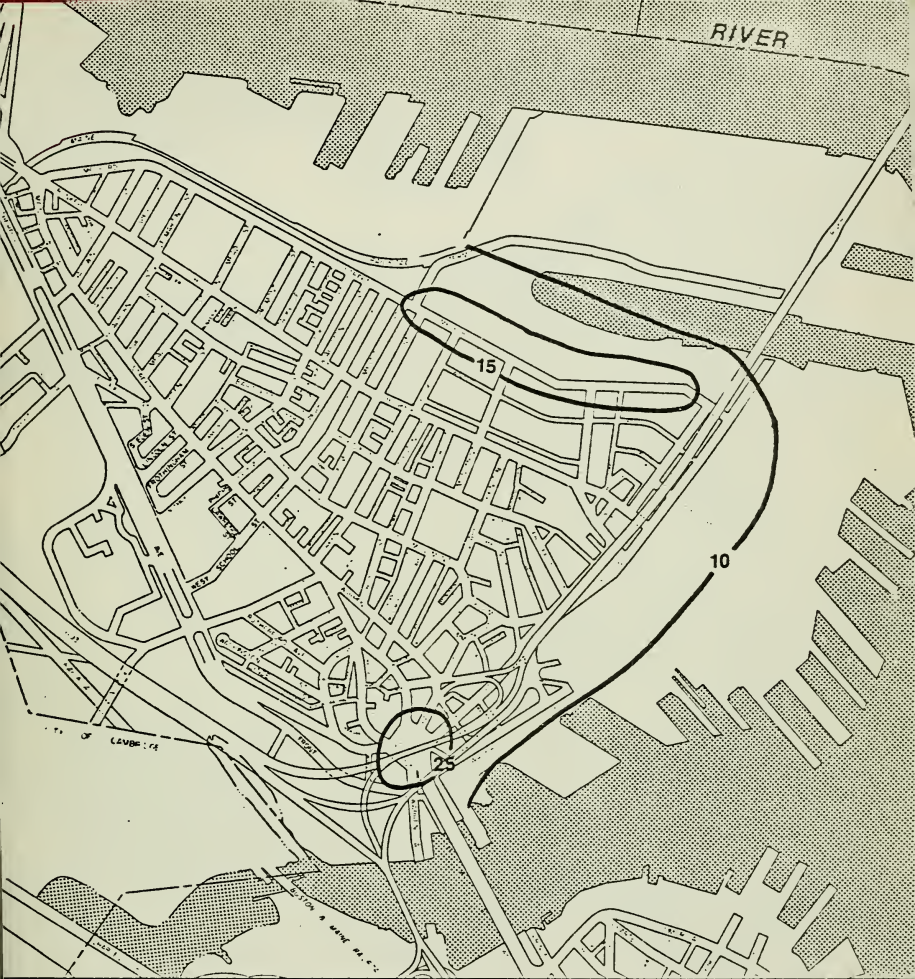


FIGURE E-23
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1976
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



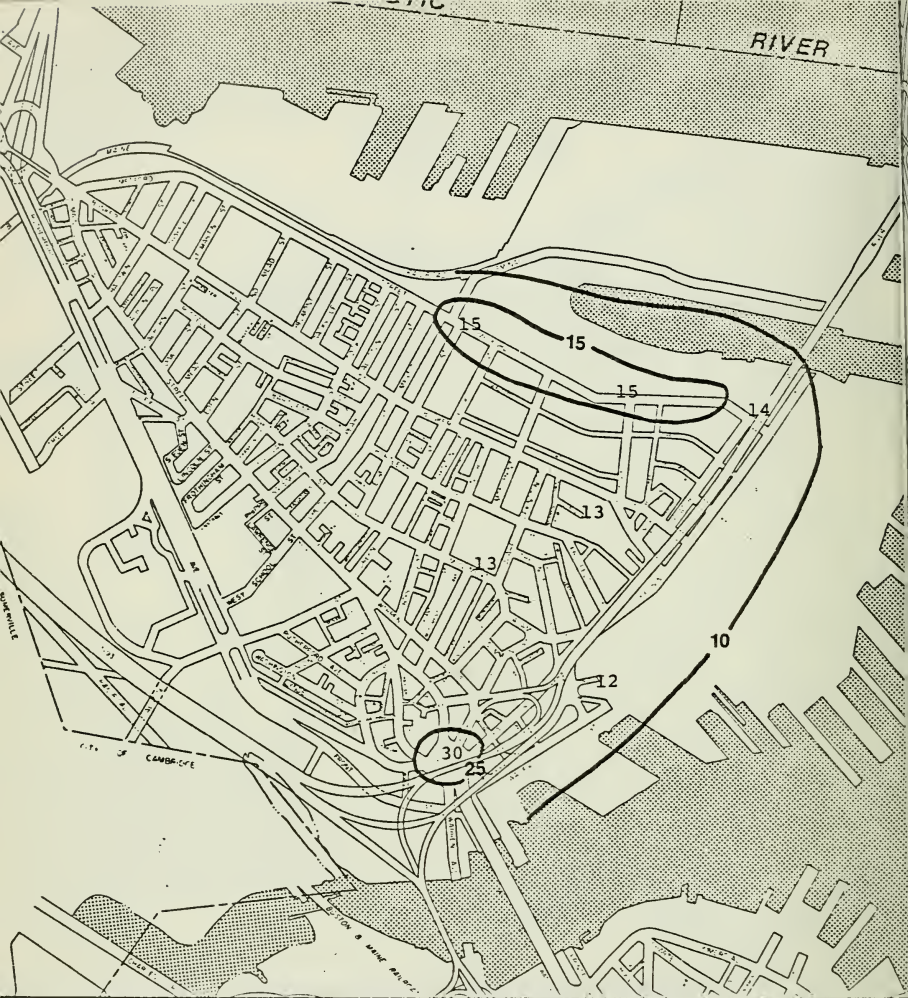


FIGURE E-24
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1976
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



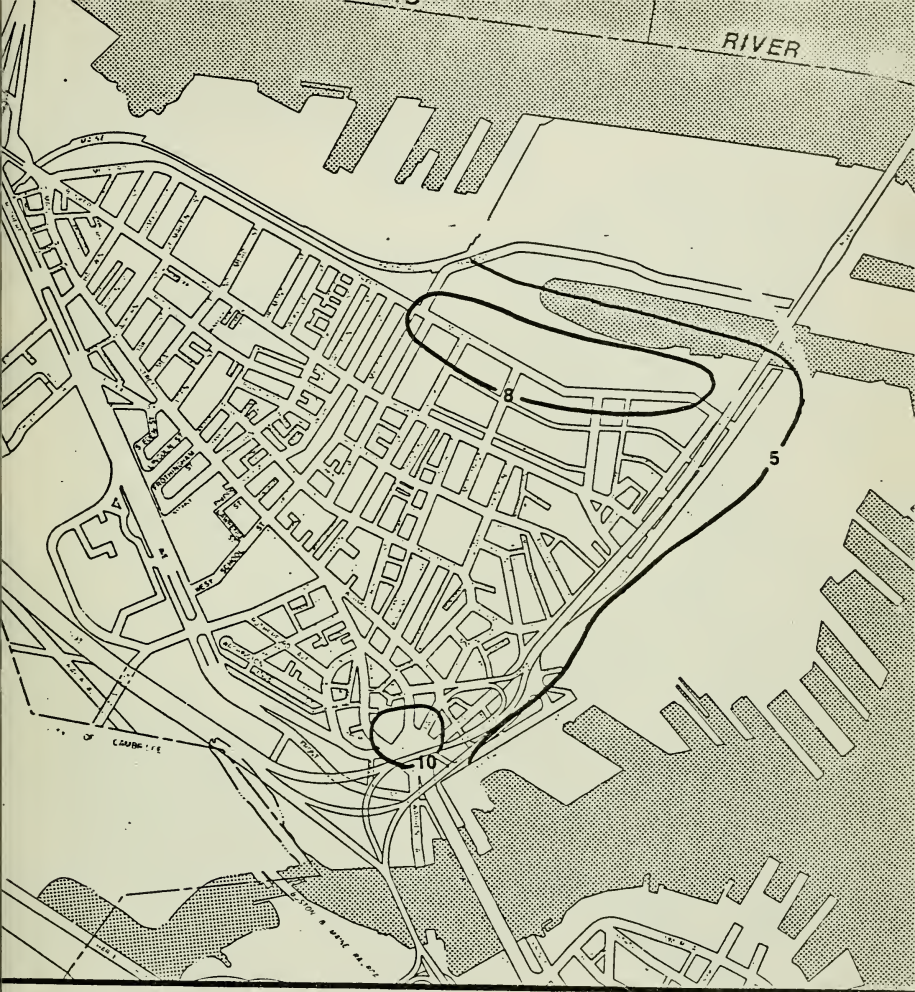


FIGURE E-25
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



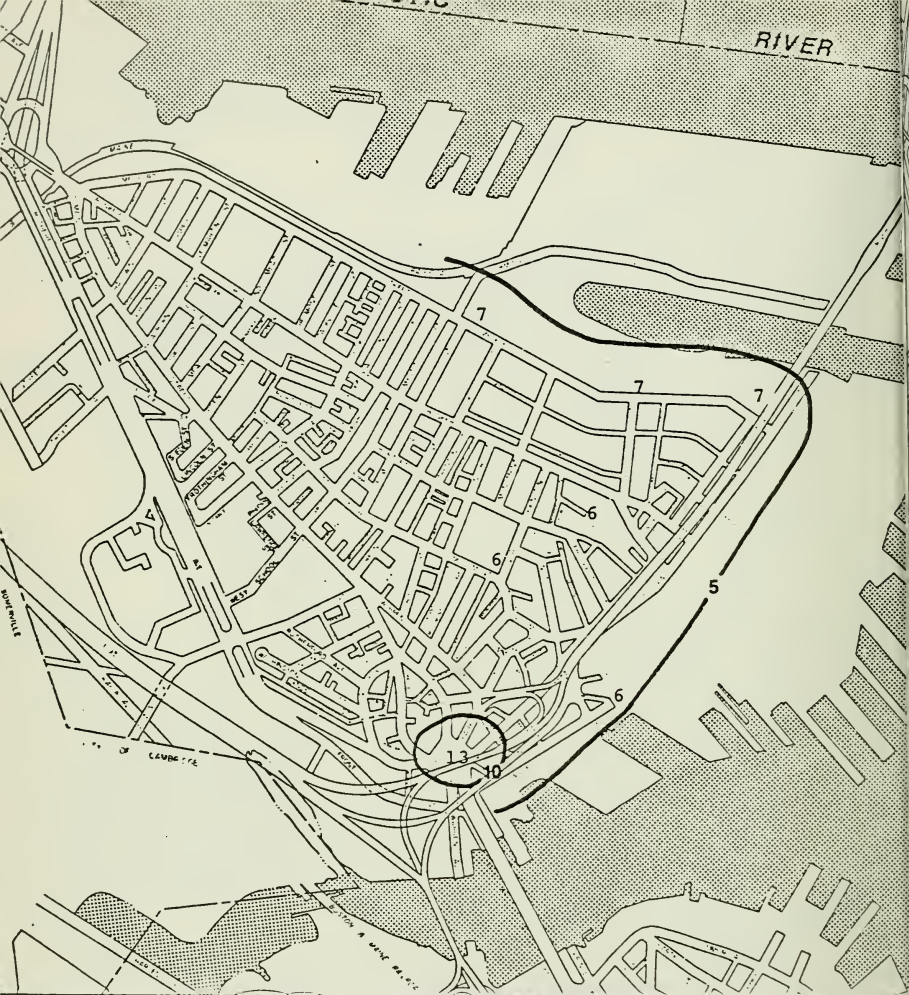


FIGURE E-26
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



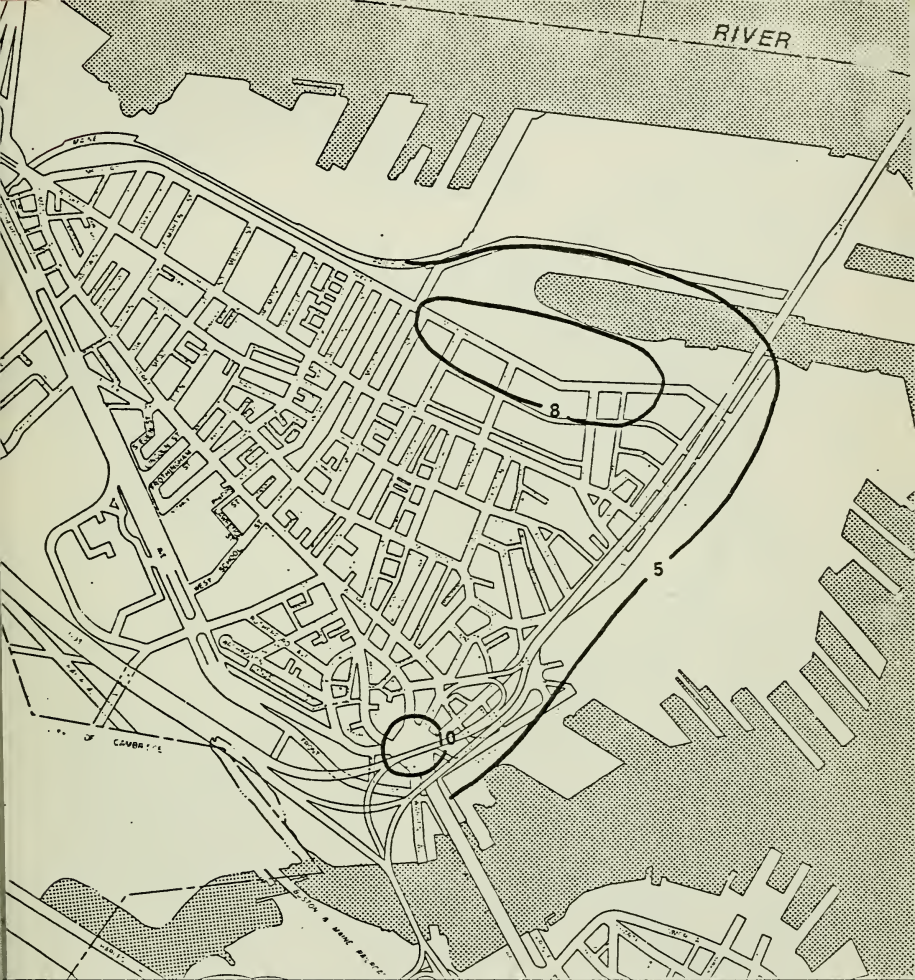


FIGURE E-27
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 1 (NO-BUILD)

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



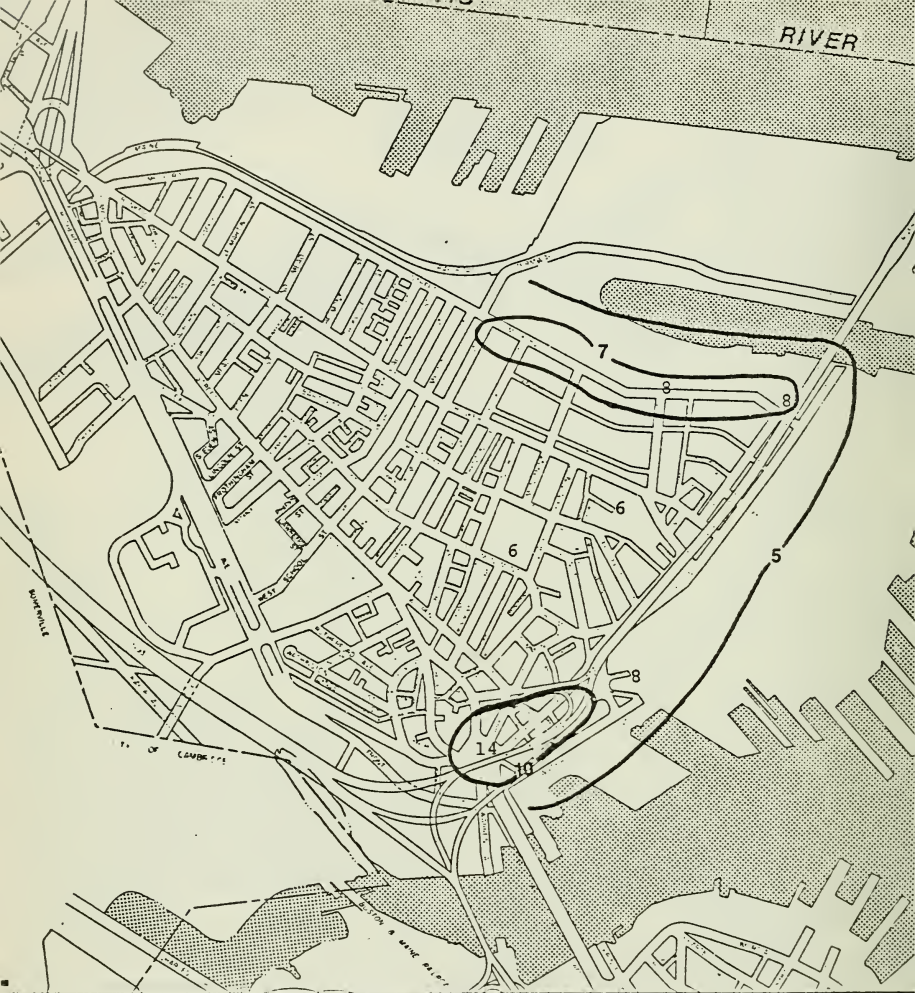


FIGURE E-28
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVES 2, 2A, 3

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



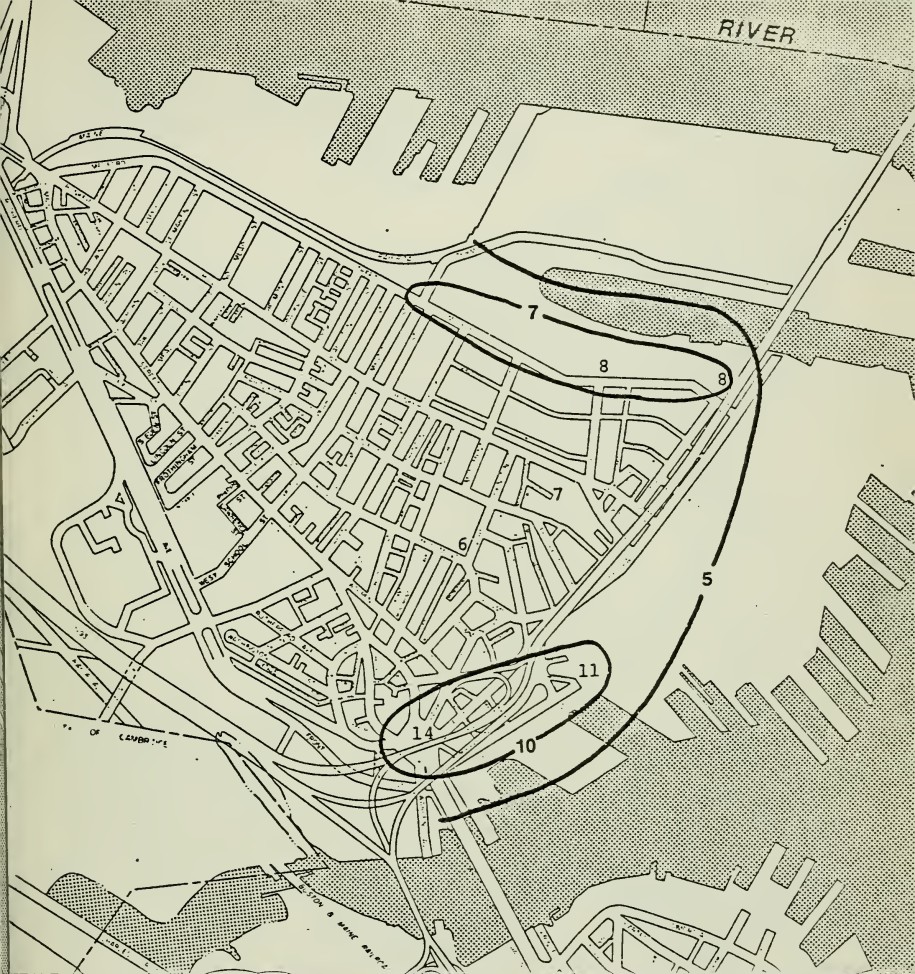


FIGURE E-29
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION A
 BUILD ALTERNATIVE 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement





FIGURE E-30
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1985
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVES 2, 2A, 3, 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



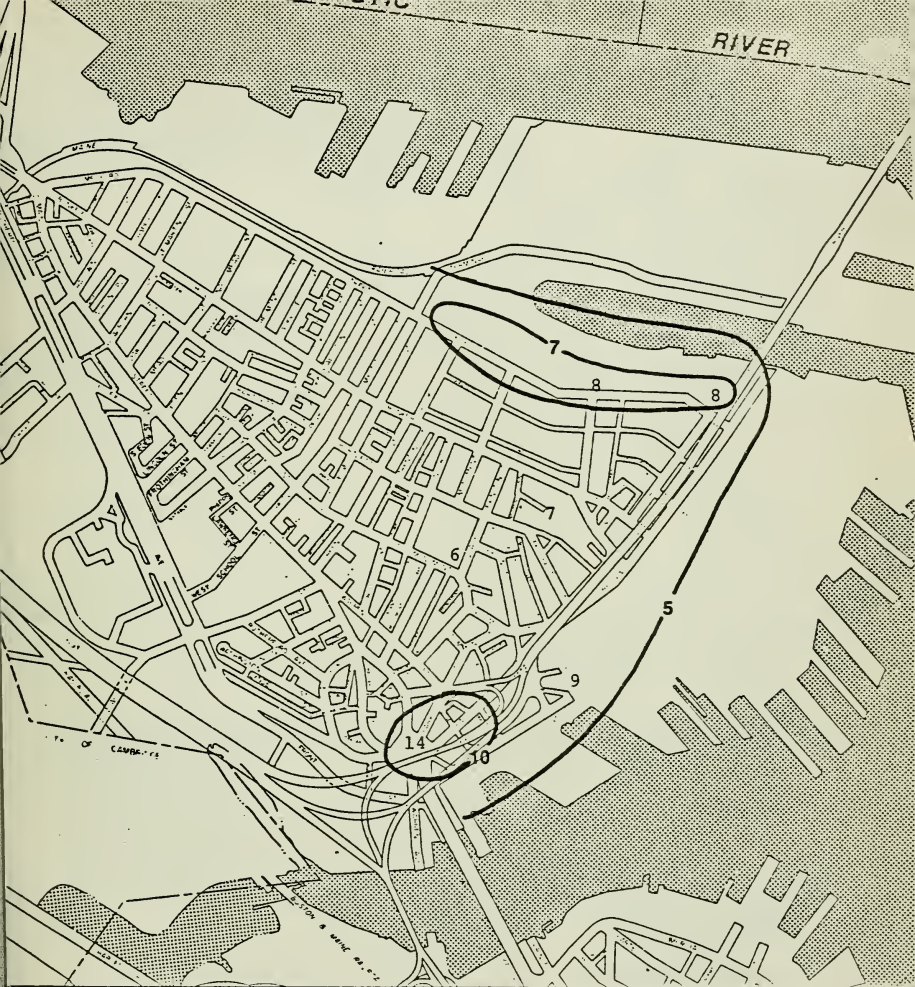


FIGURE E-31
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVE 2, 2A, 3

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



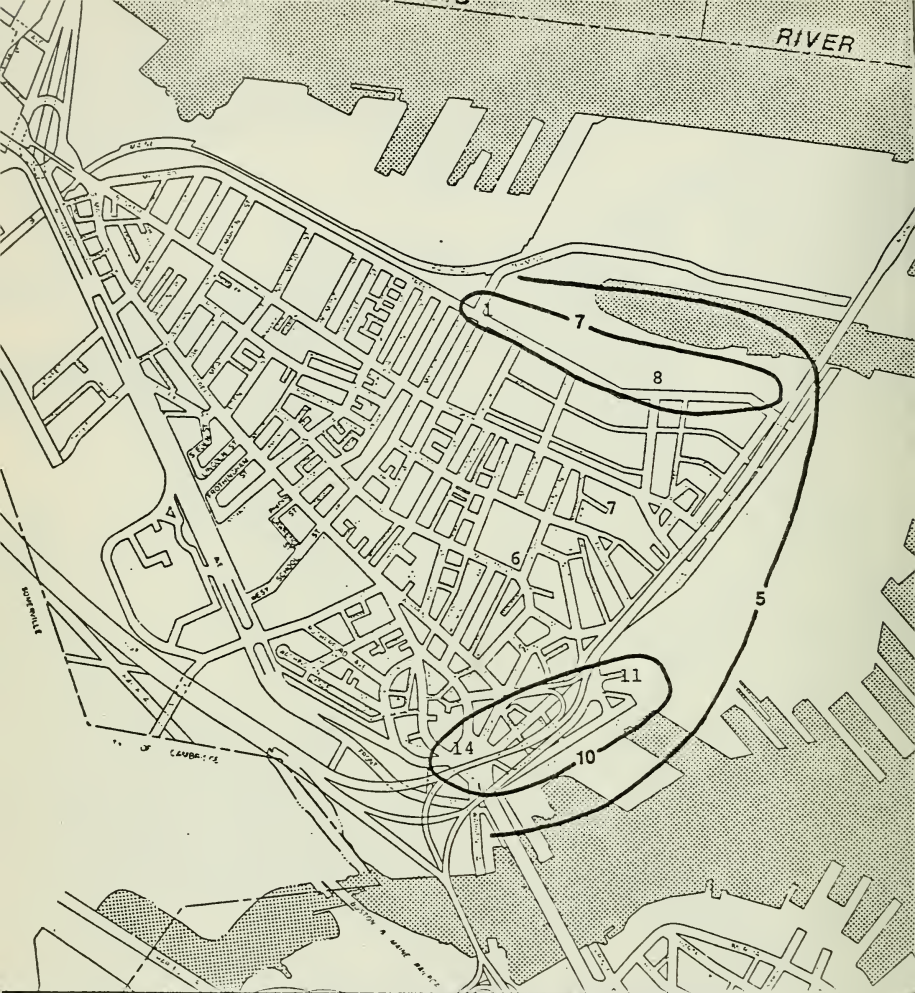


FIGURE E-32
 WORST CASE EIGHT-HOUR CARBON MONOXIDE
 CONCENTRATIONS (PPM), 1995
 TRAFFIC PROJECTION B
 BUILD ALTERNATIVE 4

Chelsea-Water Street Connector
 Little Mystic Channel Crossing
 Draft Environmental Impact Statement



TABLE E-13

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS (PPM) AT SELECTED
SENSITIVE RECEPTORS - TRAFFIC PROJECTION A

Receptor	No-Build			Build Alt. 2,2A,3			Build Alt. 4		
	1976	1985	1995	1976	1985	1995	1976	1985	1995
Bunker Hill Monument	21.5	10.5	11.3	22.0	10.5	11.0	22.0	10.5	11.0
City Square	51.8*	23.6	23.7	51.9*	21.9	23.6	51.4*	21.9	23.6
Kent School	22.5	10.6	12.0	22.4	10.5	11.2	22.4	10.5	11.5
Navy Yard (Gate #1)	18.9	9.1	9.4	20.9	10.2	14.5	20.9	10.9	18.6*
Proposed High School Terminal and Medford Streets)	26.1	13.1	14.0	25.3	11.5	12.5	25.3	11.5	12.5
Harry Playground Chelsea and Medford Streets)	23.9	11.8	12.9	25.1	12.4	13.0	25.1	12.4	13.0
Public Housing Area Medford and Tufts Streets)	26.3	13.4	15.0	25.5	11.8	13.2	25.5	11.8	13.2

Exceeds Massachusetts and Federal 1-hour standard of 35 ppm.

* Anticipated concentrations will be lower if the capacity constraint of Alternative 4 inhibits full redevelopment of the northern Shipyard. See note on page .

TABLE E-14.

MAXIMUM EIGHT-HOUR CARBON MONOXIDE CONCENTRATIONS (PPM) AT SELECTED SENSITIVE RECEPTORS - TRAFFIC PROJECTION A

Receptor	No-Build			Build Alt. 2,2A,3			Build A	
	1976	1985	1995	1976	1985	1995	1976	1985
Bunker Hill Monument	12.4*	6.0	6.5	12.7*	6.0	6.3	12.7*	6.0
City Square	29.8*	13.6*	13.6*	29.9*	12.6*	13.6*	29.9*	12.6*
Kent School	12.9*	6.1	6.9	12.9*	6.0	6.4	12.9*	6.0
Navy Yard (Gate #1)	10.9*	5.2	5.4	12.0*	5.9	8.3	12.0*	6.0
Proposed High School (Terminal and Medford Streets)	15.0*	7.5	8.0	14.6*	6.6	7.2	14.6*	6.0
Barry Playground (Chelsea and Medford Streets)	13.7*	6.8	7.4	14.4*	7.1	7.5	14.4*	7.0
Public Housing Area (Medford and Tufts Streets)	15.1*	7.7	8.6	14.7*	6.8	7.6	14.7*	6.0

* Exceeds Massachusetts and Federal 8-hour standard of 9 ppm.

1 Anticipated concentration will be lower if the capacity constraint of Alternative 4 inhibits full redevelopment of the Shipyard. See note page

TABLE E-15
 MAXIMUM ONE-HOUR CARBON MONOXIDE CONCENTRATIONS (PPM) AT SELECTED
 SENSITIVE RECEPTORS - TRAFFIC PROJECTION B

Receptor	No-Build			Build Alt. 2,2A,3			Build Alt. 4		
	1976*	1985*	1995*	1976*	1985	1995	1976*	1985	1995
Bunker Hill Monument				10.5	11.1		10.5	11.1	
City Square				23.9	24.0		23.9	24.0	
Kent School				10.6	11.4		10.6	11.4	
Navy Yard (Gate #1)				10.6	15.2		10.7	19.1	
Proposed High School (Terminal and Medford Streets)				11.6	12.7		11.6	12.7	
Barry Playground (Chelsea and Medford Streets)				12.5	13.1		12.5	13.1	
Public Housing Area (Medford and Tufts Streets)				11.9	13.3		11.9	13.3	

* Not evaluated.

TABLE E-16

MAXIMUM EIGHT-HOUR CARBON MONOXIDE CONCENTRATIONS (PPM) AT SELECTED
SENSITIVE RECEPTORS - TRAFFIC PROJECTION B

Receptor	No-Build			Build Alt. 2,2A,3			Build Alt.	
	1976*	1985*	1995*	1976*	1985	1995	1976*	1985
Bunker Hill Monument					6.0	6.4		6.0
City Square					13.7 [†]	13.8 [†]		13.7
Kent School					6.1	6.6		6.1
Navy Yard (Gate #1)					6.1	8.7		6.1
Proposed High School (Terminal and Medford Streets)					6.7	7.3		6.7
Barry Playground (Chelsea and Medford Streets)					7.2	7.5		7.2
Public Housing Area (Medford and Tufts Streets)					6.8	7.7		6.8

* Not evaluated.

† Exceeds Massachusetts and Federal 8-hour standard of 9 ppm.

MICROSCALE ANALYSIS
OF CARBON MONOXIDE
CONCENTRATIONS AND
RELATION TO AIR
QUALITY STANDARDS

Detailed modeling simulations using the canyon option were conducted at seven receptors, identified in Figure E-12, for the thirteen impact modeling cases summarized in Table E-9. The "worst-worst" case was assumed in each instance, i.e., the joint occurrence of peak traffic and most adverse meteorological conditions. The meteorological conditions responsible for high ground-level pollutant concentrations resulting from ground-based emission sources are a shallow mixing depth, low wind speed, and stable atmospheric thermal structure. The specific meteorological conditions chosen to represent poor atmospheric dispersion and dilution of pollutants were a mixing depth of 100 meters, a mean wind speed of 1.0 miles per hour, and Pasquill's atmospheric stability class "D." The 100-meter mixing depth is a typical value corresponding to the top of the turbulent surface boundary layer in an urban area. A mean wind speed of one mile per hour was used as a conservative estimate of worst case conditions. Class "D" represents the most stable ground-level atmospheric stability characteristic of urban areas.

The APRAC-1A model was applied to predict 1-hour maximum carbon monoxide (CO) concentrations in the project area. Eight-hour maximum concentrations were calculated using the procedure described in the section "Model Calibration."

The results of the modeling simulations for the thirteen cases (Table E-9) are summarized in a series of isopleth maps (Figures E-13 through E-32) depicting the predicted 1-hour and 8-hour concentrations. Tables E-13 through E-16 show the predicted 1-hour and 8-hour concentrations, respectively, at the seven receptor locations. The model was applied to predict concentrations using all possible wind directions of a 16-point compass. Because of the complex source-receptor interactions in a large urban environment, no single wind direction produced the worst conditions at all receptor site. Therefore, the data presented in the isopleth maps and in the tables are a composite of the highest values at each receptor site.

It should be noted that the effects of CO emissions are extremely localized about each street. For this reason, the value of creating citywide CO isopleths by interpolation among receptor concentrations located within a street canyon is highly questionable. Detailed isopleths were not, therefore, included in Figures E-13 through E-32; the isopleths included in these figures represent a generalized estimate of worst case concentrations of CO. Interpolation of these values is not recommended.

Description of Receptor Locations

Seven receptor sites were selected for the modeling analysis as indicators of the change in carbon monoxide levels which would result from project implementation. Due to the extremely localized effects of CO emissions, receptors were chosen primarily on streets which would experience changes in average vehicle speed, volume, or mix directly attributable to project implementation. The effects of this project at such sites as Leverett Circle or Sullivan Square were not evaluated. The rationale associated with the selected of each of the receptors is described below.

- Lexington Street, near Monument Square. This site was selected to indicate the effect of the project within the Charlestown residential community. Due to the historic significance of the site, a great deal of pedestrian traffic is expected at this location.
- City Square. This is the site predicted to be representative of current maximum CO concentrations within the project area.
- Navy Yard (Gate #1). This site was selected as representative of the area of maximum impact of the project on ambient carbon monoxide levels. Pedestrians visiting the U.S.S. Constitution and conducting business at Gate #1 will be exposed to the CO levels predicted at this location. This site is approximately 300 feet southeast of the air quality monitoring site.
- Kent School. This receptor site was selected to serve as an indicator of the effect of rerouting traffic from Lowney Way to the Chelsea-Water Street connector.
- Barry Playground (Chelsea and Medford Streets). This site was selected to evaluate the effect of emissions from motor vehicle activity on the proposed Little Mystic Bridge.
- Proposed High School (Terminal and Medford Streets). This site was selected to indicate the effect of decreased truck traffic on Terminal and Medford Streets, particularly at the high school athletic facility.
- Residential Area (Medford and Tufts Streets). This site was selected as an indicator of the effects of decreased truck traffic in this area.

Description of Impacts by Receptor Site

The following is a summary of the impact of each of the alternatives on CO levels for each of the

projection years. The results are categorized by receptor site. This description is limited to a relative comparison among alternatives by site. The following section relates absolute predictions at these sites to ambient air quality standards for CO. Note that a description of each of the alternatives is contained in section, "Traffic Data Base - Impact Analysis Data." The no-build case was used as the base in evaluating the impact of a given alternative for a given year. Predicted concentrations resulting from each build alternative for the given year and site were then compared to this base. Build concentrations differing from the associated no-build concentrations by more than ten percent were deemed to be significant changes.

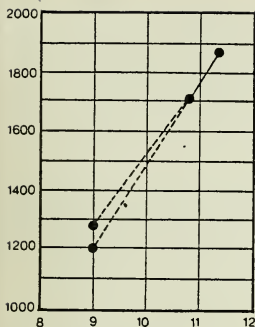
- Lexington Street, near Monument Square. There was no significant change in CO levels at this site as a result of project implementation.
- City Square. No significant change in CO levels is expected at this site as a result of project implementation.
- Navy Yard (Gate #1). CO levels resulting from each of the build options are approximately 10-50 percent greater than those which would result if the connector were not built. Among the build alternatives, CO levels resulting from implementation of Build Alternative 4 are 30 percent greater in 1995 than those resulting from Build Alternatives 2, 2A, or 3.
- Kent School. There was no significant change in CO levels at this site.
- Barry Playground (Chelsea and Medford Streets). The impact of the build options at this site is not significant.
- Proposed High School (Terminal and Medford Streets). All build options result in a 12 percent improvement in CO levels over those expected if the project were not implemented.
- Residential Area (Tufts and Medford Streets). All build alternatives result in a 12 percent decrease in CO levels over those calculated for the no-build case.

Effect of Project on Implementation and Maintenance of Ambient Air Quality Standards

As noted in the sections "Emissions from Motor Vehicles" and "Macroscale Analysis of Emission the combined intent of Federal new car emission standards and the Boston Transportation Control Plan is to reduce ambient concentrations below the Federal Air Quality Standards before May 3, 1977, and to maintain these levels once achieved. The effect of these controls, plus the increase in vehicle miles traveled resulting from growth in population and commerce, for the project area is presented in Tables E-14, E-15 in the form of predictions on air quality resulting from the no-build case. From these data, it is apparent that the 1-hour CO standard will be exceeded during 1976 in City Square and that the 8-hour standard will be exceeded at all seven receptor sites during that year. However, the effect of the implementation of emission controls is to reduce concentrations below the 1-hour standard at all receptor sites and below the 8-hour standard at all sites except City Square in 1985 and 1995.

The analysis of the build alternatives was performed to determine whether implementation of the combinations of traffic projections and build alternatives would hinder attainment or maintenance of the air quality standards. The results indicate that in 1995, implementation of Build Alternative 4 will result in exceedances of the 8-hour standard in the vicinity of the Navy Yard (Gate #1), based on both traffic projections A and B. CO concentrations near Gate 1 are primarily affected by traffic volume on Water Street. The peak hour volume on Water Street is proportional to the volume on the Chelsea-Water Streets connector. In Alternative 4, the practical limit of the connector is reached when approximately 1000 vehicles use it in the peak hour; this is 50% of total projected 1995 traffic, including vehicles generated by redevelopment of 35% of northern Shipyard potential. The associated peak hour volume on Water Street is approximately 800-900 vehicles/hour.

8 hour CO concentrations near Gate 1 have been modeled using two 1995 projections for Water Street. As shown opposite, a curve can be extrapolated to show concentrations due to different peak hour volumes. The estimates presented in this graph are expected to be quite conservative for several reasons:



Max. est. 8-hr. CO concentrations in ppm at Gate 1

- . Average speed on this road is assumed to remain constant instead of increasing due to decreased traffic. CO emissions would decrease with increasing speed.
- . Background is assumed constant. In reality, background will decrease because a smaller level of development of the north end of the Navy Yard will generate less traffic throughout the area.

These values, however, are only estimates. If 8.9 ppm can be achieved with 1200 veh./hr., 800-900 veh./hr. would clearly result in lower 8-hour CO concentration projections.

No other combination of traffic and build alternative hindered the maintenance of air quality standards which would be achieved under the no-build case. Implementation of the build alternatives would not significantly aid or hinder achievement of the 8-hour standard in City Square.

CONSTRUCTION AIR QUALITY IMPACTS

The air quality impacts associated with roadway construction are anticipated to consist principally of fugitive dust emissions associated with demolition and landfill activities and exhaust from construction vehicles. Construction of the roadway will require prior demolition of an existing structure and dismantling of a wall.

Air pollution control regulations in effect for the Metropolitan Boston Air Pollution Control District provide a basis for requiring emission controls of fugitive dust from construction activities. The applicable regulations are listed below:

Regulation 1. No person owning, leasing, or controlling the operation of any air contamination source shall willfully, negligently, or through failure to provide necessary equipment or to take necessary precautions, permit any emission from said air contamination source or sources of such quantities of air contaminants which will cause, by themselves or in conjunction with other air contaminants, a condition of air pollution.

Regulation 9.3. No person shall cause, suffer allow, or permit a building, road, driveway, or open area to be constructed, used, repaired, or demolished without applying such reasonable measures as may be necessary to prevent particulate matter from becoming airborne that may cause or contribute to a condition of air pollution.

The adverse effects of construction activities will be minimized by the following control:

An adequate water supply will be maintained to cover all dust-producing operations of building construction and demolition.

CONCLUSIONS

The study described in this report yielded the following general conclusions:

- No exceedances of the 1-hour or 8-hour ambient air quality standards for carbon monoxide were recorded at the project air quality monitoring site during the period September 5 through November 4, 1975.
- Statistical analysis of the air quality monitoring data indicates that no exceedances of carbon monoxide air quality standards most probably would have occurred at the monitoring site during 1975.
- A macroscale comparison of total vehicle miles traveled and total emissions of three motor vehicle-related pollutants among four build alternatives and a no-build alternative indicated that all build alternatives would result in fewer vehicle miles traveled and lower pollutant emissions than the no-build alternative in all design years.
- Analysis of worst case carbon monoxide concentrations at the receptor sites in the project area indicated the following. CO levels would be twelve percent lower on Medford Street as a result of project implementation. CO levels in the vicinity of the proposed connector will be 10 to 50 percent higher than those of the no-build case. CO concentrations at all other sites in Charlestown will not be significantly changed as a result of project implementation.
- Implementation of Build Alternative 4 would result in exceedances of the 8-hour air quality standard for CO in the vicinity of Gate #1 of the Navy Yard in 1995. All alternatives (no-build and build) will result in exceedances of the 8-hour standard in City Square in all years. At no other location for any alternative will 1-hour or 8-hour air quality standards for CO be exceeded in 1985 or 1995.

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APPENDIX E.1
AIR QUALITY MONITORING
AND ANALYSIS PROGRAM



APPENDIX E.1.a.
MEASURED AIR QUALITY
DATA



CITY OF BOSTON, MASS.
 SITE: BOSTON NAVAL SHIPYARD
 PROJECT: CHARLESTON STREETS IMPACT REPORT
 METHOD: NOIR
 UNITS: OF OBS. PPM
 TIME YEAR MONTH DAY HOUR PARAM CODE METHOD UNITS DP AUG1 PDG2 PDG3 PDG4 PDG5 PDG6 PDG7 RDG8 RDG9 RDG10 RDG11 RDG12

1	75	9	09	00	42101	11	07	1	11	9	13	11	13	11	13	11	9	9	15	12
1	75	9	09	12	42101	11	07	1	9	3	2	1	1	4	16	31	35	11	7	12
1	75	9	10	00	42101	11	07	1	2	16	20	23	26	27	26	30	40	36	45	37
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1	75	9	11	00	42101	11	07	1	26	19	18	19	26	44	96	83	29	22		
1	75	9	11	12	42101	11	07	1	2	21	26	29	26	24	19	16	17	15	15	14
1	75	9	12	00	42101	11	07	1	10	9	9	10	8	9	18	22	24	17		
1	75	9	12	12	42101	11	07	1	10	9	9	10	8	9	18	22	24	17		
1	75	9	13	00	42101	11	07	1	10	5	16	21	22	14	13	13	14	16	16	
1	75	9	13	12	42101	11	07	1	11	6	7	4	4	6	27	70	65	24	14	15
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1	75	9	22	00	42101	11	07	1	23	21	22	20	29	31	34	29	29			
1	75	9	22	12	42101	11	07	1	23	21	22	20	29	31	34	29	29			
1	75	9	25	00	42101	11	07	1	13	6	6	6	6	6	6	6	6	6	6	6
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1	75	9	27	12	42101	11	07	1	39	32	31	29	31	39	57	59	28	27	23	21
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1	75	9	28	12	42101	11	07	1	17	16	16	17	17	19	24	24	23	24	20	
1	75	9	29	00	42101	11	07	1	16	12	11	13	11	15	34	82	83	36	28	19
1	75	9	29	12	42101	11	07	1	16	14	13	13	11	18	19	20	24	26	25	24
1	75	9	30	00	42101	11	07	1	20	14	12	12	12	17	36	38	102			
1	75	9	30	12	42101	11	07	1	20	14	12	12	12	17	36	38	102			
1	75	10	01	00	42101	11	07	1	27	20	16	20	21	20	19	19	19	21	22	24
1	75	10	01	12	42101	11	07	1	27	20	16	20	21	20	19	19	19	21	22	24

DATE 10/23/75

SARGAD HOURLY DATA

WALDEN RESEARCH

TIME	YEAR	MONTH	DAY	HOUR	PARM	CODE	METHOD	UNITS	DP	RDG1	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	RDG10	RDG11	RDG12
1	75	10	02	02	42101	11	07	1	24	10	17	16	16	16	18	37	69	66	37	17	19
1	75	10	02	12	42101	11	07	1	24	20	19	21	29	26	26	17	12	11	11	11	9
1	75	10	03	02	42101	11	07	1	16	19	31	43	31	26	27	28	47	43	19	21	20
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1	75	10	04	02	42101	11	07	1	16	16	15	17	17	19	26	31	32	24	26	26	28
1	75	10	04	12	42101	11	07	1	58	43	28	27	21	17	18	22	20				
1	75	10	05	02	42101	11	07	1													
1	75	10	05	12	42101	11	07	1													

CITY OF BOSTON, MASS. SWINARD
 SITES - BOSTON, NAVAL AIR STATION
 PROJECT CHARLESTON STREETS 14-PACT REPORT
 TIME YEAR MONTH DAY HOUR PARAM CODE METHOD UNITS

PARAMETER CARBON MONOXIDE
 % OF DBP, ONE HOUR
 NET 400 UNIT
 UNITS OF DBP, PPM

DP 1031 RDG2 RDG3 RDG4 RDG5 RDG6 RDG7 RDG8 RDG9 RDG10 RDG11 RDG12

1	75	10	06	00	42101	11	07	1	26	47	42	38	21	19	17	20	20	23
1	75	10	06	12	42101	11	07	1	23	16	14	15	22	38	35	22	21	22
1	75	10	07	00	42101	11	07	1	23	20	18	21	22	25	29	46	40	35
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1	75	10	16	00	42101	11	07	1	13	14	15	14	13	16	27	33	27	15
1	75	10	16	12	42101	11	07	1	13	14	15	14	13	16	27	33	27	15
1	75	10	17	00	42101	11	07	1	23	17	14	12	12	14	23	44	35	19
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1	75	10	22	00	42101	11	07	1	22	29	19	10	10	22	35	64	62	42
1	75	10	22	12	42101	11	07	1	23	18	14	23	28	31	38	29	30	35

DATE 11/07/78

WALDEN RESERVOIR SARGAD HOURLY DATA

WALDEN RESERVOIR																						GRAND ROCKY CANYON									
TIME	YEAR	MONTH	DAY	HOUR	PARM	CODE	METHOD	UNITS	33	4331	RDG2	RDG3	RDG4	RDG5	RDG6	R337	RDG8	RDG9	RDG10	RDG11	RDG12										
1	75	10	23	00	42101			11	07	1	42	27	23	19	18	25	52	119	60	34	17	10									
1	75	10	23	12	42101			11	07	1	13	10	11	11	9	11	16	14	10	16	11	9									
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1	75	10	24	12	42101			11	07	1	11	9	10	11	16	28	35	31	25	21	18	16									
1	75	10	25	00	42101			11	07	1	12	16	15	12	6	5	8	9	14	12	10	10									
1	75	10	25	12	42101			11	07	1	7	10	11	6	10	22	18														
1	75	10	27	00	42101			11	07	1	3	7	5	6	5	5	7	6	6	6	6	6									
1	75	10	27	12	42101			11	07	1	13	15	13	13	13	40	41	34	33	25	22	20									
1	75	10	28	00	42101			11	07	1	51	61	29	21	23	26	41	66	65	19	13	22									
1	75	10	28	12	42101			11	07	1	13	15	13	13	13	40	41	34	33	25	22	20									
1	75	10	29	00	42101			11	07	1	13	16	16	15	14	20	38	71	79	52	33	22									
1	75	10	29	12	42101			11	07	1	22	23	27	31	30	28	31	23	20	18	15	15									
1	75	10	30	00	42101			11	07	1	13	11	10	10	10	10	15	25	26	22	15	14									
1	75	10	30	12	42101			11	07	1	13	17	19	20	17	16	17	14	11	14	12	10									
1	75	10	31	00	42101			11	07	1	3	7	6	6	5	7	13	23	23	16	14	14									
1	75	10	31	12	42101			11	07	1	19	15	17	21																	
1	75	11	03	00	42101			11	07	1				26	46	74	69	55	45	40	27	23									
1	75	11	03	12	42101			11	07	1	21	14	10	9	9	10	17	10	36												
1	75	11	04	00	42101			11	07	1																					
1	75	11	04	12	42101			11	07	1																					

CITY OF BOSTON, MASS.
SITE: BOSTON NAVAL SHIPYARD
PROJECT: CHARLESTON STREETS IMPACT REPORT

PARAMETER WIND SPEED
T.1. OF OBS. ONE HOUR

METHOD INSTRUMENTAL
UNITS OF OBS. MILES/HOUR

TIME YEAR MONTH DAY HOUR	PARK CODE	METHOD	UNITS	DF	ROCI	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	RDG10	RDG11	RDG12
1 75 9 08 00	61101	11	12	1	43	83	66	66	86	51	82	74	81	96	103	91
1 75 9 09 00	61101	11	12	1	96	122	93	99	97	76	81	80	94	109	120	140
1 75 9 09 12	61101	11	12	1	130	130	120	152	130	129	80	81	88	82	70	73
1 75 9 10 00	61101	11	12	1	68	95	88	74	73	71	64	61	73	80	105	80
1 75 9 10 12	61101	11	12	1	88	81	79	66	83	78	72	59	38	36	51	50
1 75 9 11 00	61101	11	12	1	50	60	57	57	40	19	46	47	49	59	70	104
1 75 9 11 12	61101	11	12	1	104	119	126	128	135	127	126	121	112	108	119	127
1 75 9 12 00	61101	11	12	1	136	141	126	122	131	137	144	147	162	160	159	159
1 75 9 12 12	61101	11	12	1	146	139	136	82	46	53	37	66	73	74	78	62
1 75 9 13 00	61101	11	12	1	50	56	47	43	46	42	31	44	39	42	43	41
1 75 9 13 12	61101	11	12	1	43	49	70	77	89	93	91	78	84	78	72	71
1 75 9 14 00	61101	11	12	1	74	95	105	96	96	66	61	62	77	83	97	95
1 75 9 14 12	61101	11	12	1	77	95	91	97	70	76	88	52	54	45	40	37
1 75 9 15 00	61101	11	12	1	35	37	35	29	33	39	39	31	33	20	30	60
1 75 9 15 12	61101	11	12	1	61	76	83	51	76	70	89	78	74	93	76	72
1 75 9 16 00	61101	11	12	1	71	71	50	55	49	81	45	56	75	75	84	88
1 75 9 16 12	61101	11	12	1	90	93	72	74	66	60	41	45	45	46	34	36
1 75 9 17 00	61101	11	12	1	31	26	20	22	24	23	21	23	28	16	42	51
1 75 9 17 12	61101	11	12	1	63	81	87	79	78	70	60	51	39	50	45	31
1 75 9 18 00	61101	11	12	1	32	31	31	28	31	31	36	38	43	36	37	73
1 75 9 18 12	61101	11	12	1	80	93	97	81	79	73	59	63	68	64	64	84
1 75 9 19 00	61101	11	12	1	80	89	91	75	73	56	63	74	95	99	86	60
1 75 9 19 12	61101	11	12	1	80	81	75	88	85	76	70	65	72	43	50	52
1 75 9 20 00	61101	11	12	1	36	18	15	12	21	18	27	19	28	35	27	39
1 75 9 20 12	61101	11	12	1	34	35	33	33	70	61	66	64	56	73	55	70
1 75 9 21 00	61101	11	12	1	81	83	80	63	92	80	71	74	74	82	77	85
1 75 9 21 12	61101	11	12	1	77	80	81	83	92	70	60	73	81	67	84	66
1 75 9 22 00	61101	11	12	1	73	95	82	79	78	74	68	78	71	79	79	79
1 75 9 22 12	61101	11	12	1	80	80	89	92	105	94	86	78	74	84	86	84
1 75 9 23 00	61101	11	12	1	79	94	84	65	40	32	38	21	20	21	18	24
1 75 9 23 12	61101	11	12	1	29	34	24	38	22	25	29	30	24	35	48	48
1 75 9 24 00	61101	11	12	1	53	52	58	55	71	71	66	65	89	87	101	90
1 75 9 24 12	61101	11	12	1	96	104	100	108	80	104	82	68	83	85	81	88

WALDEN RESEARCH SAROAD FOURLY DATA DATE 10/23/75 PAGE 3

TIME	YEAR	MONTH	DAY	HOUR	PARM	CODE	METHOD	UNITS	DP	RDG1	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	PDG10	RDG11	PDG12
1	75	9	25	00	61101	11	12	1	106	86	89	97	66	110	134	109	110	108	129	119	
1	75	9	25	12	61101	11	12	1	119	124	122	134	126	119	98	101	95	92	83	80	
1	75	9	26	00	61101	11	12	1	77	67	31	35	40	40	44	49	43	44	43	47	
1	75	9	26	12	61101	11	12	1	53	61	36	38	34	31	29	26	32	35	34	47	
1	75	9	27	00	61101	11	12	1	38	60	46	51	27	11	18	24	20	35	40	46	
1	75	9	27	12	61101	11	12	1	38	47	35	46	20	19	21	23	61	45	53	58	
1	75	9	28	00	61101	11	12	1	53	70	85	97	82	82	70	83	91	94	113	102	
1	75	9	28	12	61101	11	12	1	100	103	103	90	90	90	53	53	43	39	52	58	
1	75	9	29	00	61101	11	12	1	62	51	36	35	36	40	45	51	53	37	29	26	
1	75	9	29	12	61101	11	12	1	46	58	59	59	58	53	45	88	92	55	83	72	
1	75	9	30	00	61101	11	12	1	66	74	57	44	38	31	33	41	62	70	97	99	
1	75	9	30	12	61101	11	12	1	105	91	94	83	92	76	66	78	94	91	83	84	
1	75	10	01	00	61101	11	12	1	77	90	82	71	63	53	47	51	55	58	58	62	
1	75	10	01	12	61101	11	12	1	61	121	121	159	141	137	129	113	90	85	66	47	
1	75	10	02	00	61101	11	12	1	25	31	40	31	35	44	44	58	74	87	78	67	
1	75	10	02	12	61101	11	12	1													

WALDEN RESEARCH SARGAD HOURLY DATA

CITY OF BOSTON, MASS.
 SITE - BOSTON NAVAL SHIPYARD
 PROJECT CHARLESTON STREETS IMPACT REPORT
 TIME YEAR MONTH DAY HOUR PARM CODE METHOD UNITS PP 3251 RDG2 RDG3 RDG4 RDG5 RDG6 RDG7 RDG8 RDG9 RDG10 RDG11 RDG12

PARAMETER WIND SPEED
 T.10 OF DBS. ONE HOUR
 MET-430 INSTRUMENTAL
 UNITS OF DBS. MILES/HOUR

1	75	10	02	00	61101	11	12	1	37	77	93	91	74	40	91	110	111	109	115	109
1	75	10	02	12	61101	11	12	1	37	77	93	91	74	40	91	110	111	109	115	109
1	75	10	03	00	61101	11	12	1	93	79	60	71	65	66	75	81	87	63	63	90
1	75	10	03	12	61101	11	12	1	134	120	124	119	123	109	97	100	127	124	108	112
1	75	10	04	00	61101	11	12	1	101	90	77	90	94	71	71	71	70	90	91	71
1	75	10	04	12	61101	11	12	1	92	72	60	70	61	68	37	33	19	24	10	11
1	75	10	05	00	61101	11	12	1	11	12	16	19	19	11	7	8	13	77	88	66
1	75	10	05	12	61101	11	12	1	73	78	78	67	46	21	72	96	110	102	96	96
1	75	10	06	00	61101	11	12	1	75	93	73	80	62	95	61	100	74	77	108	93
1	75	10	06	12	61101	11	12	1	113	126	122	119	105	94	95	118	124	98	93	53
1	75	10	07	00	61101	11	12	1	97	64	62	87	106	97	70	99	104	103	92	88
1	75	10	07	12	61101	11	12	1	75	66	72	77	64	53	42	34	30	36	42	45
1	75	10	08	00	61101	11	12	1	34	57	40	44	53	66	61	73	83	74	66	66
1	75	10	08	12	61101	11	12	1	75	70	67	77	53	63	43	48	25	34	29	60
1	75	10	09	00	61101	11	12	1	92	110	110	108	94	90	90	81	98	93	83	77
1	75	10	09	12	61101	11	12	1	72	60	55	82	82	52	52	40	44	38	20	26
1	75	10	10	00	61101	11	12	1	42	27	30	49	19	6	12	25	20	19	46	54
1	75	10	10	12	61101	11	12	1	52	73	77	85	107	122	103	73	79	74	59	45
1	75	10	11	00	61101	11	12	1	52	48	45	34	45	54	50	39	40	72	70	72
1	75	10	11	12	61101	11	12	1	52	101	100	106	106	102	61	109	121	122	134	132
1	75	10	12	00	61101	11	12	1	59	20	16	47	44	36	32	32	41	62	77	82
1	75	10	12	12	61101	11	12	1	77	65										
1	75	10	14	00	61101	11	12	1	93	61	101	83	72	44	20	23	25	31	21	27
1	75	10	14	12	61101	11	12	1	27	26	20	24	28	41	30	70	59	40	31	34
1	75	10	15	00	61101	11	12	1	55	61	50	53	53	43	40	24	19	21	71	81
1	75	10	15	12	61101	11	12	1	32	65	74	89	53	44	66	102	101	125	144	156
1	75	10	16	12	61101	11	12	1	161	151	142	144	123	112	95	86	79	61	76	76
1	75	10	17	00	61101	11	12	1	65	59	60	44	36	30	29	44	32	47	44	37
1	75	10	17	12	61101	11	12	1	43	66	68	69	64	77	55	63	70	94	97	88
1	75	10	18	00	61101	11	12	1	75	95	110	108	115	140	137	82	60	46	77	100
1	75	10	18	12	61101	11	12	1	32	69	66	80	72	85	101	111	101	86	95	108
1	75	10	19	00	61101	11	12	1	137	95	107	114	115	135	129	120	117	118	152	144
1	75	10	19	12	61101	11	12	1	135	136	140	136	135	137	143	141	139	151	139	133

DATE 11/07/76

WALDEN RESEARCH - SAROAD HOURLY DATA

TIME	YEAR	MONTH	DAY	HOUR	PART	CODE	METHOD	UNITS	33	3331	RDG2	RDG3	RDG4	RDG5	RDG6	RD27	RDG8	RDG9	RDG10	RDG11	RDG12
1	75	10	20	00	01101	11	12	1	123	116	89	82	66	93	72	54	64	55	76	71	
1	75	10	20	12	01101	11	12	1	75	64	59	55	41	36	31	29	29	23	23	69	
1	75	10	21	00	01101	11	12	1	37	49	89	67	66	78	65	92	90	97	117	137	
1	75	10	21	12	01101	11	12	1	123	114	128	114	89	72	76	88	92	98	86	86	
1	75	10	22	00	01101	11	12	1	75	79	72	80	75	73	68	61	62	63	63	85	
1	75	10	22	12	01101	11	12	1	57	120	143	88	93	73	57	53	46	29	41	48	
1	75	10	23	00	01101	11	12	1	32	25	13	7	9	12	10	14	15	27	32	46	
1	75	10	23	12	01101	11	12	1	61	66	77	70	65	67	52	45	51	53	53	42	
1	75	10	24	00	01101	11	12	1	45	40	21	31	17	11	10	14	15	22	44	52	
1	75	10	24	12	01101	11	12	1	45	61	54	63	27	11	21	65	47	27	31	32	
1	75	10	25	00	01101	11	12	1	15	14	21	19	25	23	26	21	37	43	52	56	
1	75	10	25	12	01101	11	12	1	51	53	63	131	164	54	84	66	64	62	49	35	
1	75	10	26	00	01101	11	12	1	43	47	56	62	46	29	51	64	95	97	95	93	
1	75	10	26	12	01101	11	12	1	73	60	52	46	46	38	32	39	27	30	21	23	
1	75	10	27	00	01101	11	12	1	17	33	19	27	30	21	23	22	28	85	92	87	
1	75	10	27	12	01101	11	12	1	55	74	85	80	64	69	53	55	47	27	22	21	
1	75	10	28	00	01101	11	12	1	15	25	22	23	31	23	23	24	22	55	46	41	
1	75	10	28	12	01101	11	12	1	13	43	45	41	37	22	53	79	73	70	73	81	
1	75	10	29	00	01101	11	12	1	55	56	60	50	44	50	41	58	63	44	47	41	
1	75	10	29	12	01101	11	12	1	31	57	73	72	77	80	47	41	48	63	72	75	
1	75	10	30	00	01101	11	12	1	73	75	70	62	46	37	37	98	93	87	105	112	
1	75	10	30	12	01101	11	12	1	93	90	82	87	91	100	97	79	85	89	81	76	
1	75	10	31	00	01101	11	12	1	72	80	86	90	94	92	88	99	105	81	77	76	
1	75	10	31	12	01101	11	12	1	71	76	67	56	48	37	26	19	23	20	19	33	
1	75	11	01	00	01101	11	12	1	35	36	49	76	103	62	48	69	112	126	144	147	
1	75	11	01	12	01101	11	12	1	182	159	163	158	169	205	184	155	146	147	150	121	
1	75	11	02	00	01101	11	12	1	97	90	72	69	50	63	55	50	62	53	66	60	
1	75	11	02	12	01101	11	12	1	52	61	73	76	71	39	45	55	45	45	59	56	
1	75	11	03	00	01101	11	12	1	55	79	78	70	71	79	82	74	62	75	89	80	
1	75	11	03	12	01101	11	12	1	53	97	90	73	42	23	31	32	43	53	73	78	
1	75	11	04	00	01101	11	12	1	73	78	99	109	123	119	115	112	111	107			
1	75	11	04	12	01101	11	12	1													

WALDEN RESEARCH SRAOD HOURLY DATA

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DATE 10/23/75

CITY OF BOSTON, MASS.

SITE - BOSTON COMMONS

PROJECT CHARLESTON STREETS IMPACT REPORT

TIME YEAR MONTH DAY HOUR PARM CODE METHOD UNITS

PARAMETER WIND DIRECTION
T.1. OF OBS. ONE HOUR

METHOD INSTRUMENTAL
UNITS OF OBS. DEGREES

DP	RDG1	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	RDG10	RDG11	RDG12
1 75 9 08 00 01102	14 0	161	159	171	160	116	105	230	200	209	228	242
1 75 9 08 12 01102	14 0	258	243	252	261	387	240	269	295	305	307	311
1 75 9 09 00 01102	14 0	303	300	294	295	302	299	309	303	298	298	302
1 75 9 09 12 01102	14 0	289	295	298	300	299	293	304	303	299	332	340
1 75 9 10 00 01102	14 0	341	321	320	320	304	289	295	295	303	294	280
1 75 9 10 12 01102	14 0	290	297	297	298	296	297	297	284	270	260	259
1 75 9 11 00 01102	14 0	236	257	255	245	250	230	225	222	225	225	224
1 75 9 11 12 01102	14 0	229	228	227	230	227	228	229	226	226	232	230
1 75 9 12 00 01102	14 0	234	232	231	272	260	278	287	327	344	327	333
1 75 9 12 12 01102	14 0	317	310	323	320	328	319	311	324	324	333	343
1 75 9 13 00 01102	14 0	331	294	283	256	276	268	274	278	285	287	298
1 75 9 13 12 01102	14 0	327	320	329	327	332	331	341	327	333	336	321
1 75 9 14 00 01102	14 0	301	303	300	303	302	303	305	299	287	319	328
1 75 9 14 12 01102	14 0	014	085	157	203	257	251	234	227	228	245	246
1 75 9 15 00 01102	14 0	226	162	252	265	265	267	268	260	258	258	259
1 75 9 15 12 01102	14 0	255	259	256	250	256	250	276	257	224	236	265
1 75 9 16 00 01102	14 0	284	304	294	296	309	313	330	333	16	216	94
1 75 9 16 12 01102	14 0	92	102	102	98	89	89	85	84	84	93	81
1 75 9 17 00 01102	14 0	30	30	4	37	312	316	17	32	19	32	78
1 75 9 17 12 01102	14 0	111	138	140	122	99	101	91	110	101	102	112
1 75 9 18 00 01102	14 0	136	136	140	141	128	132	101	113	133	158	147
1 75 9 18 12 01102	14 0	129	129	102	104	103	102	116	129	122	136	143
1 75 9 19 00 01102	14 0	150	71	81	84	114	97	110	159	141	145	146
1 75 9 19 12 01102	14 0	150	154	159	172	239	238	222	227	214	232	237
1 75 9 20 00 01102	14 0	241	240	234	218	238	217	210	217	245	250	252
1 75 9 20 12 01102	14 0	261	246	255	248	241	245	245	254	257	261	268
1 75 9 21 00 01102	14 0	284	280	285	291	290	293	290	291	300	292	264
1 75 9 21 12 01102	14 0	261	295	266	265	252	259	255	266	263	265	258
1 75 9 22 00 01102	14 0	262	251	240	276	309	302	335	316	346	24	4
1 75 9 22 12 01102	14 0	150	322	351	151	128	82	147	141	95	100	120
1 75 9 23 00 01102	14 0	74	72	67	71	84	75	66	73	75	82	101
1 75 9 23 12 01102	14 0	96	99	77	66	74	74	68	62	72	68	79
1 75 9 24 00 01102	14 0											
1 75 9 24 12 01102	14 0											

TIME YEAR MONTH DAY HOUR PARM CODE METHOD UNITS	DP	RDG1	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	RDG10	RDG11	RDG12
1 75 9 25 00 01102 11	14	0	77	70	70	74	83	85	103	95	90	103	79
1 75 9 25 12 01102 11	14	0	78	84	80	85	87	87	87	87	88	82	81
1 75 9 26 00 01102 11	14	0	94	91	79	56	58	53	70	41	34	50	75
1 75 9 26 12 01102 11	14	0	79	76	60	85	44	44	44	10	72	111	132
1 75 9 27 00 01102 11	14	0	135	151	151	165	206	94	136	242	271	327	336
1 75 9 27 12 01102 11	14	0	345	340	340	336	359	339	306	292	320	326	304
1 75 9 28 00 01102 11	14	0	305	292	295	294	294	292	290	293	298	306	316
1 75 9 28 12 01102 11	14	0	326	326	325	314	316	314	320	322	316	301	286
1 75 9 29 00 01102 11	14	0	293	301	303	315	313	298	296	294	297	330	328
1 75 9 29 12 01102 11	14	0	150	149	153	156	161	154	146	230	235	264	269
1 75 9 30 00 01102 11	14	0	262	267	269	278	264	275	277	272	260	250	231
1 75 9 30 12 01102 11	14	0	255	263	241	250	246	250	250	221	232	259	282
1 75 10 01 00 01102 11	14	0	269	263	267	268	270	265	262	273	273	262	259
1 75 10 01 12 01102 11	14	0	250	231	221	229	223	226	226	227	223	226	231
1 75 10 02 00 01102 11	14	0	279	295	296	311	262						
1 75 10 02 12 01102 11	14	0											

VALDEN RESEARCH SAROAD HOURLY DATA

DATE 11/07/78

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CITY OF BOSTON, MASS.
 SITES - BOSTON NAVAL SHIPYARD
 PROJECT CHARLESTOWN STREETS IMPACT REPORT
 TIME YEAR MONTH DAY HOUR PARM CODE METHOD UNITS 32 325L RDG2 RDG3 RDG4 RDG5 RDG6 RDG7 RDG8 RDG9 RDG10 RDG11 RDG12

PARAMETER WIND DIRECTION
 T.I. OF OBS. ONE HOUR
 METHOD INSTRUMENTAL
 UNITS OF OBS. DEGREES

1	75	10	02	00	01102	11	14	0	122	339	340	337	335	331	334	339	341	340	335	345
1	75	10	02	10	01102	11	14	0	131	330	325	311	310	299	291	292	291	296	298	274
1	75	10	03	00	01102	11	14	0	171	267	273	275	263	264	262	255	255	263	272	275
1	75	10	04	00	01102	11	14	0	171	271	278	270	276	273	274	274	284	290	301	307
1	75	10	04	10	01102	11	14	0	117	336	340	340	319	310	319	339	2	47	24	16
1	75	10	05	00	01102	11	14	0	335	332	324	309	340	355	1	352	290	131	133	124
1	75	10	05	10	01102	11	14	0	117	116	121	112	116	133	223	224	225	226	225	230
1	75	10	06	00	01102	11	14	0	231	226	221	220	236	224	227	226	260	264	251	234
1	75	10	06	10	01102	11	14	0	154	257	254	262	279	250	305	303	299	299	300	318
1	75	10	07	00	01102	11	14	0	111	324	314	318	339	334	327	330	337	343	341	348
1	75	10	07	10	01102	11	14	0	117	335	336	342	327	339	349	325	312	312	312	289
1	75	10	08	00	01102	11	14	0	332	293	293	301	303	297	294	269	290	301	314	322
1	75	10	08	10	01102	11	14	0	131	327	332	345	16	88	121	121	118	94	50	69
1	75	10	09	00	01102	11	14	0	133	183	158	131	153	168	155	160	152	224	170	252
1	75	10	09	10	01102	11	14	0	133	81	88	86	95	108	102	97	98	113	103	115
1	75	10	10	00	01102	11	14	0	273	293	294	301	320	18	330	327	354	147	158	153
1	75	10	10	10	01102	11	14	0	144	135	131	125	115	124	134	172	163	168	168	184
1	75	10	11	00	01102	11	14	0	132	192	177	153	149	145	157	150	150	150	148	146
1	75	10	11	10	01102	11	14	0	133	150	126	127	131	123	130	130	126	139	144	146
1	75	10	12	00	01102	11	14	0	133	154	118	90	98	110	131	102	104	117	102	81
1	75	10	12	10	01102	11	14	0	56	45										
1	75	10	14	00	01102	11	14	0	313	325	306	316	313	320	345	304	303	295	267	308
1	75	10	14	10	01102	11	14	0	132	292	301	286	281	299	283	271	278	320	359	154
1	75	10	15	00	01102	11	14	0	135	156	121	124	99	99	112	155	91	314	278	264
1	75	10	15	10	01102	11	14	0	273	294	291	284	287	265	273	286	291	296	300	302
1	75	10	16	00	01102	11	14	0	132	313	312	305	307	304	309	314	301	290	291	294
1	75	10	17	00	01102	11	14	0	293	285	303	304	305	316	323	2	20	29	42	35
1	75	10	17	10	01102	11	14	0	133	157	151	139	145	148	154	132	137	138	132	111
1	75	10	18	00	01102	11	14	0	133	110	103	106	114	119	120	104	68	22	27	48
1	75	10	18	10	01102	11	14	0	53	55	61	65	70	76	81	82	77	72	75	78
1	75	10	19	00	01102	11	14	0	72	78	81	80	78	74	76	78	77	78	84	81
1	75	10	19	10	01102	11	14	0	81	78	81	81	83	85	84	89	87	94	92	98

WALDEN RESEARCH SARGENT-HOURLY DATA DATE 11/07/75 PAGE 2

TIME	YEAR	MONTH	DAY	HOUR	PARM	CODE	METHOD	UNITS	D ²	R321	RDG2	RDG3	RDG4	RDG5	RDG6	RDG7	RDG8	RDG9	RDG10	RDG11	RDG12
1	75	10	20	00	01102	11	14	0	23	65	67	61	74	79	72	64	66	61	61		
1	75	10	20	12	01102	11	14	0	63	51	69	60	36	35	25	37	1	318	327	290	
1	75	10	21	00	01102	11	14	0	193	277	277	279	280	276	274	265	261	256	260	272	
1	75	10	21	12	01102	11	14	0	273	269	274	274	271	282	279	262	259	270	271	272	
1	75	10	22	00	01102	11	14	0	157	256	263	261	268	260	269	276	263	267	269	290	
1	75	10	22	12	01102	11	14	0	155	294	300	308	311	315	313	296	347	307	304	305	
1	75	10	23	00	01102	11	14	0	193	300	329	302	61	322	323	328	17	109	115	127	
1	75	10	23	12	01102	11	14	0	153	155	123	132	123	123	123	160	160	199	146	166	
1	75	10	24	00	01102	11	14	0	159	172	158	135	112	68	12	45	69	110	140	144	
1	75	10	24	12	01102	11	14	0	143	125	123	124	114	101	161	232	234	148	137	133	
1	75	10	25	00	01102	11	14	0	123	107	111	99	112	106	115	105	187	202	226	217	98
1	75	10	25	12	01102	11	14	0	153	116	121	135	147	214	155	187	202	226	217	209	
1	75	10	26	00	01102	11	14	0	145	255	273	286	209	291	266	295	324	333	329	327	
1	75	10	26	12	01102	11	14	0	141	346	350	7	345	343	343	357	353	359	327	327	
1	75	10	27	00	01102	11	14	0	152	124	134	130	111	118	119	115	143	124	198	192	
1	75	10	27	12	01102	11	14	0	152	124	134	130	111	118	119	115	143	124	198	192	
1	75	10	28	00	01102	11	14	0	22	301	306	301	300	305	305	300	123	137	139	144	
1	75	10	28	12	01102	11	14	0	153	150	152	148	144	128	231	259	267	264	268	279	
1	75	10	29	00	01102	11	14	0	172	283	280	289	304	287	284	292	290	275	283	273	
1	75	10	29	12	01102	11	14	0	175	281	277	297	321	332	323	333	338	337	345		
1	75	10	30	00	01102	11	14	0	155	355	356	343	340	346	344	340	344	339	334	336	
1	75	10	30	12	01102	11	14	0	155	347	343	351	353	347	351	356	351	342	344	348	
1	75	10	31	00	01102	11	14	0	135	338	334	335	337	337	336	338	344	356	359	347	
1	75	10	31	12	01102	11	14	0	137	326	323	325	329	328	330	320	293	292	307	291	
1	75	11	01	00	01102	11	14	0	152	269	239	220	229	240	242	237	231	245	247	247	
1	75	11	01	12	01102	11	14	0	152	247	244	240	240	240	240	236	236	237	262	266	
1	75	11	02	00	01102	11	14	0	239	264	270	269	269	268	269	270	283	277	281	274	
1	75	11	02	12	01102	11	14	0	235	298	280	298	294	285	272	269	266	273	263	271	
1	75	11	03	00	01102	11	14	0	244	263	262	264	264	259	267	272	279	268	273	282	
1	75	11	03	12	01102	11	14	0	243	284	293	294	294	278	280	271	264	267	263	265	
1	75	11	04	00	01102	11	14	0	259	260	270	273	275	275	279	271	268	266			

APPENDIX A.1.b

QUALITY ASSURANCE AND DAILY OPERATING PRO- CEDURES

The following is a brief summary of the quality assurance procedures adapted from EPA Quality Assurance Guidelines [3] for this program. Also included are the daily operating procedures through which the quality assurance procedures were implemented.

Carbon Monoxide

The analyzers and recorders were calibrated in the laboratory and readjusted in the field. Zero and span were checked daily, and the gain and zero setting were recorded to assure valid data. The moisture removal system and the particulate filter were checked daily and renewed as required. Daily checks of sampling lines, flow rates, and the recorder output were performed to troubleshoot the system. Table A-1 presents the results of instrument calibration using NBS certified gas.

TABLE A-1

CO CALIBRATION - INTERTECH URAS 2 CO ANALYZER - CHARLESTOWN NAVAL SHIPYARD

NBS Certified Gas ppm	Recorded ppm
9.74	9.2 - 9.5

Wind Speed/Wind Direction

The wind speed indicator was calibrated on the 0-50 mph scale, and the wind direction was calibrated by Ambient Metrics, Inc.

In addition to these quality assurance operating procedures, two more checks were employed. First, a quality assurance check by the program supervisor was performed without prior notice to the operator to assure that he was following the documented field sampling procedures. Second, all measured data were checked and verified by a qualified engineer other than the operator. This data assurance check involved starting with the raw data and independently calculating the final reduced data. No discrepancies were found.

DAILY OPERATING PRO- CEDURES

Carbon Monoxide (Intertech URAS 2 Analyzer)

Check rotameter for:

1. Record reading as "FINAL" for test just completed.

2. If flow dropped >50% of initial, void test.
3. If flow dropped >20%, check particulate filter.
4. Adjust flow as required. Record as "INITIAL."

Check strip chart recorder for:

1. Chart speed control setting
2. Gain control setting
3. Ink trace for readability
4. Signs of excess noise

Rectify as required.

Zero and span control settings:

Check zero and gain control settings on knobs. If changed, void data.

Water vapor control:

Check anhydrous CaSO_4 and change as necessary.

Calibration check:

1. Run zero gas for at least five minutes. Record this value as "UNADJUSTED ZERO."
2. Adjust zero if necessary and wait five minutes. Record as "ADJUSTED ZERO."
3. Run span gas for at least five minutes. Adjust if required.
4. Check all the sample introduction system, lines, traps, manifolds, etc. for any disturbances, blockages, or breaks. Rectify as required.

Wind Speed/Wind Direction (Climatronics WM II 540)

1. Check the alignment of the vane to assure valid wind direction data.
2. Check the power cord from the vane to the recorder.
3. Check recorder paper to assure adequate supply and correct operation of the take-up roll.

APPENDIX A.1.c

FEDERAL REGISTER METHODS
FOR CARBON MONOXIDE

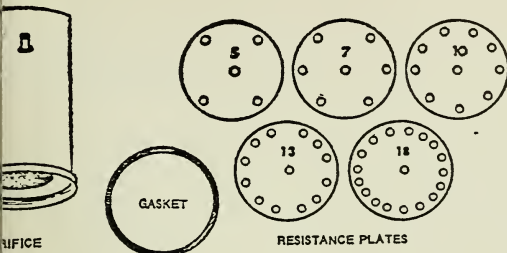


Figure B3. Orifice calibration unit.

dix C-Measurement Principle and Calibration Procedure for the Continuous Measurement of Carbon Monoxide in the Atmosphere (Non-Dispersive Infrared Spectrometry)

Principle and applicability.
This principle is based on the absorption of infrared radiation by carbon monoxide in a non-dispersive photometer. Both gases pass into matched cells, each containing a selective detector and CO. The CO in the sample cell absorbs infrared radiation only at its characteristic frequencies and the detector is sensitive to those frequencies. With a non-polluting gas in the reference cell, and with CO in the sample cell, the signals from the detectors are balanced electronically. CO introduced into the sample cell will absorb radiation, which reduces the temperature and pressure in the detector cell and causes a diaphragm. This displacement is detected electronically and amplified to produce an output signal.

An analyzer based on this principle may be considered a reference method only. It has been designated as a reference method in accordance with Part 53 of this title.

[40 FR 7042, February 18, 1975]

Paragraphs 2 through 6

Revoked, 40 FR 7042, February 18, 1975]

Procedure.

Calibrate the instrument as described in 1. All gases (sample, zero, calibration, span) must be introduced into the analyzer system. Figure C1 shows a typical flow diagram. For specific operating instructions, refer to the manufacturer's manual.

Calibration.

1. Calibration Curve. Determine the linearity of the detector response at the

operating flow rate and temperature. Prepare a calibration curve and check the curve furnished with the instrument. Introduce zero gas and set the zero control to indicate a recorder reading of zero. Introduce span gas and adjust the span control to indicate the proper value on the recorder scale (e.g., on 0-58 mg./m.³ scale, set the 46 mg./m.³ standard at 80 percent of the recorder chart). Recheck zero and span until adjustments are no longer necessary. Introduce intermediate calibration gases and plot the values obtained. If a smooth curve is not obtained, calibration gases may need replacement.

9. Calculations.

9.1 Determine the concentrations directly from the calibration curve. No calculations are necessary.

9.2 Carbon monoxide concentrations in mg./m.³ are converted to p.p.m. as follows:
$$\text{p.p.m. CO} = \text{mg. CO/m.}^3 \times 0.873$$

10. Bibliography.

The Intech NDIR-CO Analyzer by Frank McElroy. Presented at the 11th Methods Conference in Air Pollution, University of California, Berkeley, Calif., April 1, 1970.

Jacobs, M. B. et al., J.A.P.C.A. 9, No. 2, 110-114, August 1959.

MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Pittsburgh, Pa.

Beckman Instruction 1635B, Models 215A, 315A and 415A Infrared Analyzers, Beckman Instrument Company, Fullerton, Calif.

Continuous CO Monitoring System, Model A 5811, Intertech Corp., Princeton, N.J.

Bendix-UNOR Infrared Gas Analyzers, Roncerverte, W. Va.

ADDENDA

[Revoked, 40 CFR 7042, February 18, 1975]



APPENDIX A.1.d

SITE SELECTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUBJECT: Review of CO Monitoring Sites for EIS

DATE: September 10, 1975

FROM: Norman J. Beloin, Inventory & Monitoring Section

THRU: William J. Walsh, Chief, Inventory & Monitoring Section *WJW*

TO: Wallace Woo, Chief, Technical Assistance Section

As discussed, I visited Walden Research's CO monitoring site at the Boston Naval Shipyard, and reviewed the Quality Assurance procedures. Peter Guldberg of Walden Research accompanied me on the site visit, and Walter Brooks of the BRA accompanied us on the visit to the Boston Naval Shipyard. The following is a brief description of each site:

1.

2. Boston Naval Shipyard - The site on the roof (second floor) of Building 204 is acceptable for the CO monitor. I suggested that the monitor be placed on the NW side of the building with the air inlet probe extending out over the side of the building. The air inlet would be approximately 30-40 feet from the I-95 Tobin Bridge Expressway. Due to the heavy traffic volume and restricted air flow, elevated CO levels are expected.

Both myself and Warren Oldaker reviewed the CO Quality Assurance Procedures submitted by Walden Research. The methodology employed is acceptable and, in general, the procedures were adequate. However, there are several points which should be included:

1. A daily span and zero check are recommended.
2. The silica gel should be checked daily and the date of replacement recorded. Both temperature and relative humidity should also be recorded. As humidity can be a significant problem, some evidence as to effectiveness of the procedures used to remove the water vapor should be presented.
3. The concentration of the span and calibration gases should be traceable to a National Bureau of Standards reference gas.
4. Multipoint calibrations should be performed and the frequency specified.
5. The frequency of the rotometer calibrations should be specified. The rotometer serial number should also be recorded.
6. The frequency of the Data Quality Check should be specified.

For assistance in establishing a Quality Assurance Program, Walden should refer to "Guidelines for Development of a Quality Assurance Program Reference Method for the Continuous Measurement of Carbon Monoxide in the Atmosphere, EPA-R4-73-028A.

cc: Warren Oldaker
Peter Guldberg, Walden Research
Val Descamps

APPENDIX A.2

SOURCES AND EFFECTS OF AIR POLLUTANTS

A brief review of the known effects of air pollutants on health, materials, and other receptors is presented in the following sections. The air pollutants covered in this review are those for which Federal and State Air Quality Standards have been promulgated. Although scientific evidence is far from complete, extensive experimental and epidemiological studies [17,18,19] have verified that air pollution adversely affects health, the environment, and the economy, with the extent of such effects dependent on concentration levels and exposure time.

CARBON MONOXIDE

Carbon monoxide (CO) is a colorless, odorless, and tasteless gas. Background measurements over uninhabited areas indicate levels between 0.02 and 0.05 ppm, due mainly to the oxidation of methane emitted by decaying organic matter. In the urban environment, CO is the most prevalent air pollutant, and it is present at levels which are several orders of magnitude higher than the natural background. CO in the urban environment arises primarily from the incomplete combustion of carbonaceous fuels, the largest source resulting from the combustion of gasoline by motor vehicles. Since CO is relatively inert once emitted, the concentrations tend to maximize close to the source (a freeway, for example), and the pollution problem is usually localized.

CO is a toxic chemical compound. The principal toxic action of CO is a result of its combination with blood hemoglobin (Hb) to form carboxyhemoglobin. This compound interferes with the life-sustaining transfer of oxygen from the lungs to the body tissues and the return of carbon dioxide from the tissues to the lungs. The affinity of Hb for CO is more than 200 times greater than that for oxygen. Hence, the presence of relatively small amounts of CO results in significant interference with essential cardiovascular-respiratory functions. Relatively brief exposure to high levels (40 ppm) can impair time interval discrimination, visual acuity, and other psychomotor functions. An exposure time and level associated with normal commuter, freeway driving is adequate to produce these effects. Longer exposure to higher levels may cause headaches, drowsiness, and eventually respiratory failure and death. Persons most affected by CO are those suffering from heart and pulmonary ailments. Cigarette

smokers have high background concentrations in their bloodstreams and may also be sensitized. CO is capable of reacting with other hemoproteins and may also interfere with certain enzyme systems. In addition, a recent research study [20] indicates that deaths resulting from overexposure to CO may be caused by massive poisoning of the cytochrome system of the body's tissue cells by CO, resulting in the rapid death of these cells. Plants are insensitive to the presence of CO, even at the high levels found in urban environments.

HYDROCARBONS

Hydrocarbons are organic compounds consisting solely of hydrogen and carbon. The largest component of world-wide hydrocarbon emissions is non-reactive methane from biological sources and is of lesser concern than the reactive compounds such as the olefins, aromatics, diolefins, and ethylene. These reactive hydrocarbons combine with nitrogen oxides in a complex series of chemical reactions to form photochemical oxidants. The chief sources of these reactive species are man-made and arise from the incomplete combustion of carbonaceous fuels by motor vehicles, industrial process evaporative losses, and other fuel use activities.

There are not known direct health effects from exposure to gaseous hydrocarbons at levels found in the atmosphere. The major known pollutant effects of hydrocarbons result from the formation of photochemical oxidants which are discussed in a following subsection. Phototoxic effects caused by alkenes to orchid and carnation crops in California near point source have, however, been observed, but the total damage is relatively small.

OXIDES OF NITROGEN

On a world-wide basis, man-made sources of nitrogen oxides produce only one-tenth the amount produced naturally, arising primarily from biological bacterial processes. However, urban concentrations are generally 10 to 100 times higher than background, non-urban levels. In the urban environment, nitrogen oxides arise mainly from high-temperature combustion processes which are followed by rapid cooling. Several oxides of nitrogen are found in the atmosphere, but nitric oxide (NO) and nitrogen dioxide (NO₂) are the most important air pollutants. Most of the man-made nitrogen oxides are in the form of NO, which is subsequently oxidized in the atmosphere to the more toxic

and irritating NO_2 , a reddish-brown gas with a pungent odor. Motor vehicle emissions and the burning of coal, oil, and natural gas are the principal sources of NO .

In addition to contributing to the formation of photochemical oxidants, nitrogen oxides have several direct damaging effects. NO_2 exerts its primary toxic effect on the lungs. High concentrations are lethal to most animal species, causing pulmonary edema. Epidemiological studies have correlated NO_2 concentrations with increases in respiratory diseases in people. Chronic plant injury is associated with exposure to NO_2 . Associated problems include decreased visibility, textile fading and deterioration, and corrosion of electrical wiring.

PHOTOCHEMICAL OXIDANTS

Photochemical oxidants are not directly emitted by any man-made source in significant quantities. Rather, they are a class of atmospheric pollutants which arises from a complex series of atmospheric photochemical reactions between hydrocarbons and oxides of nitrogen in the presence of sunlight. The two most important reaction products are ozone and the peroxyacyl nitrates (PAN). In addition, large numbers of deleterious by-products are formed during the reactions, including nitrate aerosols. Oxidants are considered a regional problem because levels found in rural areas are often as high as those measured in the city.

The observed effects of photochemical oxidants include eye and respiratory irritation, increased aging of red blood cells, impaired delivery of oxygen to the body tissues, shortness of breath, and impairment of the performance of athletes. A recent study which correlated the frequency of traffic accidents with oxidant levels showed that high oxidant levels lead to dulled senses, impaired vision, and increased driver irritability. Other experiments have found oxidants damaging to animals and vegetation. Associated material problems include the fading of textiles, dyes, and paint and the cracking of rubber.

SULFUR COMPOUNDS

Sulfur oxides arise from the combustion of carbonaceous fuels containing sulfur compounds, most notably coal and petroleum. The predominant form is sulfur dioxide (SO_2), a colorless gas with a vile, pungent odor. In ambient air, it oxidizes and hydrolyzes to form acid sulfates

and sulfuric acid by a number of different atmospheric reaction processes. Precipitation scavenging of sulfates and sulfur oxides, the principal mechanism for removal of these compounds from the atmosphere, causes increased acidity in the associated rainfall.

SO₂ is normally a mild irritant of the upper respiratory tract. However, when aerosols are present, SO₂ can be adsorbed (coated) onto the particulate surfaces, oxidized into one of the acid sulfates, and carried deep into the lung. There, in the presence of moisture, it can hydrolyze to sulfuric acid on the pulmonary membrane. Correlation studies have linked SO₂ and sulfates with the incidence of acute respiratory diseases and their associated mortality rates. In addition, laboratory experiments have found sulfur oxides to be damaging to animals, plants, building material art works, textiles, and paints.

The current controversy over the use of catalytic mufflers on new model cars concerns the possibility that they may cause the formation of sulfuric acid mist in the automobile exhaust from the small amounts of sulfur present in gasoline. Based on the most recent EPA test results [21], it now appears that both non-catalyst cars and catalyst cars without air pumps emit very low levels of sulfuric acid. By contrast, catalyst cars equipped with air pumps would emit high levels. It is this potential for high emissions that led the EPA Administrator to suspend the 1977 hydrocarbon and carbon monoxide standards. Without the suspension, manufacturers might have added air pumps to 1977 model cars to meet the stricter standards. In addition, EPA is expected to promulgate emission standards for sulfuric acid in the near future to ensure that the implementation of stricter emission standards for carbon monoxide, hydrocarbons, and nitrogen oxides will not cause a concurrent health hazard from sulfuric acid emissions.

PARTICULATES

On a global basis, the bulk of particulate matter in the air is of natural origin. However, in urban areas, the proportion due to industrial processes, fuel burning, and road dust predominates. Particulates play an important role in air pollution for several reasons. For example, chronic exposure to high concentrations of particulate matter may be injurious

to the lungs. This pollutant can also act in a synergistic role in potentiating the toxic effects of certain other pollutants, such as SO_2 . Some metallic ashes catalyze the oxidation of SO_2 into acid sulfates. Particulate matter is responsible for atmospheric turbidity and reduced visibility; it is also thought to affect the earth's energy balance through changes in the earth's albedo and absorption of radiation.

It is now generally agreed that particle size is a major factor in determining the toxic effects of airborne particulate matter [22]. In general, pulmonary deposition increases as particle diameters decrease, with particulate matter less than $1\text{ }\mu\text{m}$ in diameter of primary importance. Recent studies have shown a number of potentially toxic trace species, including lead, predominate in small, lung-depositing particles in most urban aerosols.

There is much concern over ambient concentrations of lead particulates in urban environments; the major source of such airborne lead (98%) is the burning of gasoline containing tetraethyl lead additives [23]. The health effects of airborne lead are somewhat controversial. Lead is known to be a poison, and it is cumulative in the body. Lead poisoning can give rise to several acute and chronic diseases. It has been reported that lead in the bloodstream may interfere with maturation and development of red blood cells, cause disturbance of enzyme activity, and interfere with liver and kidney functions. However, studies [24] have shown no cases of illness or death to animals or people traceable to lead particulates from motor vehicle exhausts.

Of all lead normally taken into the body of the typical urban adult, only 25-30% comes from inhaled air [24]. With the development and increasing use of unleaded fuels, this contribution should decrease with time. There are currently no Federal or Massachusetts Ambient Air Quality Standards for lead particulates.





PURPOSES

Measured noise data in the study area provide a useful reference point. In urban situations they describe the combined noise from different types of sources that could not be predicted accurately by any computational method. In areas overwhelmed by noise from one highway the data could serve as a calibration of the highway noise prediction method. In some urban situations ambient noise may already be so high that an additional highway or a relocated ramp produces no significant increase over the existing noise conditions.

SELECTION OF SAMPLING SITES

A number of sites previously measured fall into the Chelsea-Water Street study area. The ambient noise data were gathered in 1972-73 as part of the North Terminal Area study which partially overlaps the current study area. The validity of these data was tested by measuring five representative sites again. The selection of the five sites to be cross-checked was made in collaboration with the local FHWA office. In addition to these sites five others, uniquely related to the current study, were evaluated. Three of these lie within the currently inactive Boston Naval Shipyard.

All of the selected sampling sites represent conditions typical of the study area reflecting various distances from the Tobin Bridge and local streets with various traffic volume and mix characteristics. In addition, several specific sensitive receptors such as a playground and the future high school site were selected.

MEASUREMENT PROCEDURE

All current data were obtained during rush hour periods on weekdays, with neither precipitation nor strong wind to interfere with the measurements. Microphone locations are typically 5 ft. above grade and in an area free of major obstructions such as parked vehicles. Where sidewalk noise levels in narrow streets are desired the sound level meter is generally placed on the roof of the technician's car on the side nearest the curb. The tape recorded data sample is typically 10 minutes long. Occasionally irrelevant portions of data such as inquisitive youngsters' voices have to be deleted from the analysis. Calibration signals are added to each tape recorded data sample in the field to assure accurate recordings. All data is A-weighted before it is tape recorded. Statistical analysis of the data is performed on the tape recorded data in the laboratory.

NOISE LEVEL DESCRIPTION

All quantitative values of noise referred to in this report are A-weighted, that is, the total noise spectrum is modified by filtering it with the standardized weighting func-

NOISE IMPACT STUDY
DESCRIPTION

The technical process of assessing the noise impact of the various alternatives is straightforward in principle. Quantitative noise levels from the various highway configurations are computed and weighed against a noise level criterion to determine the magnitude of the impact. There are several factors that complicate the process, especially in urban situations. The main difficulty is that the existing network of highways and local arterials usually produces so much noise already that added highways or modifications of existing highways change the overall noise by amounts that are similar to the accuracy of the traffic noise prediction method. Thus, except for a very obvious change in traffic flow or a roadway alignment the overall noise impact will almost always be minor.

Prediction of urban traffic noise in the vicinity of roadways handling small peak hour volumes, less than 500 VPH, is inaccurate, particularly for truck dominated traffic using existing prediction techniques.^{1,2} The predicted noise values for combinations of low volume and distances typical of secondary urban roadways tend to be unrealistically high, typically 5 dB. For those observer locations several blocks from major roadways, but for which local traffic data is unavailable a reasonable estimate of total ambient noise can be made on a statistical basis related to population density.³ For example, in Charlestown we have taken the inhabited area as a triangle with Sullivan Square, Bunker Hill Yacht Club and the Charles River B&M railroad bridge over the Charles River as its corners. The enclosed area is about .56 square miles. The population projections of Charlestown, based on various sources, were taken to be as follows:

<u>Year</u>	<u>Population</u>	<u>People/Square Mile</u>	<u>Average Ambient Noise, L₁₀ dB</u>
1975	17,500	31,000	68
1985	20,000	36,000	68.5
1995	22,500	40,000	69

The accuracy of this value at this time is only + 6 dB, however, these values do agree quite closely with the range of ambient noise levels obtained in the study area.

This noise impact assessment incorporates detailed noise calculations at 16 representative receptors in the study area. The calculations of existing and future traffic noise - 1985 and 1995 are based on the geometrical detail of the four alternative connector schemes, 2, 2A, 3 and 4 and the existing and projected peak hour traffic volumes. The corresponding traffic noise levels for each alternative and time frame are then compared to each other, to the FHWA noise criterion for highway noise, and the measured ambient noise levels.

tion labelled "A". Basically this filter duplicates the frequency response of the average human ear sufficiently to allow A-weighted levels to be widely used to evaluate annoyance, hearing impairment, and the loudness of most common types of sounds. The numerical values of traffic and ambient noise levels may be more meaningful if one compares them to the representative common noise values listed in Table I.

The information of principal interest in highway noise analyses is the A-weighted level exceeded 10 percent of the sample time [i.e., L_{10} dB(A)]. For completeness the mean (fifty percent) level, L_{50} , and the residual level, L_{90} , were recorded. Although not included in Table II, L_{90} lies within 1 to 3 dB of L_{50} for all 1975 observations.

RESULTS

The ambient noise data for the new measurement sites as well as earlier data relevant to this study are listed in Table II. Measurement locations are identified along with the L_{10} values in Figure 1. Since the traffic volumes and other urban commercial activities remain reasonably uniform throughout the day the noise level is found to be nearly constant from about 7 a.m. to 5:30 p.m. on each weekday.

At most urban sites noise is dominated by trucks, hence noise on weekends, holidays and between the evening and morning rush hour will be considerably less. Nighttime noise levels in residential areas were not measured for the current study, however, previous data obtained by our firm and by others⁴ indicate a decrease of about 10 to 12 dB for areas far (over 500 ft.) from major highways and 4 to 8 dB for areas closer to such highways. The minimum noise level occurs in the early morning hours, between 1 and 4 a.m.

A small but highly probable decrease in the measured ambient noise was found between 1972 and 1975. For those sites near the Tobin Bridge ramps where the bridge traffic noise predominates, there is an average drop of 3 dB reflecting a significant reduction in overall traffic particularly trucks during the busiest daytime hours. Traffic flow data for these two years indicate an ADT reduction from about 77 to 66 thousand for an average weekday. Although this change in daily volume alone could not account for the observed reduction, the remaining noise level drop may be due to a relatively greater decrease in noisy types of trucks operating during the peak traffic hours. This latter fact could not be confirmed.

Interestingly, the more remote ambient noise measurement sites show no significant change in noise during the busiest daytime hours, consistent with the fact that the population density and the apparent land use in those areas have not changed over the past three years. Thus, all 1972 data obtained within about 200 ft. of the Tobin Bridge could be reduced by 3 dB to approximate accurately the 1975

noise levels. In Figure 1 the noise levels shown for the five comparison measurement sites are the 1975 data. However, other 1972 data in this figure have not been reduced and therefore correspond to the values listed in Table II.

INSTRUMENTATION

Instrumentation utilized in ambient noise statistics were measured using the following equipment:

1. General Radio Precision Sound Level Meter and Analyzer Model 1933, Serial No. 2333, equipped with 1/2 in. electret microphone having flat random incidence response and a polyurethane foam windscreen.
2. Nagra (Kudelski) Tape Recorder, Model 4.2, battery operated.
3. General Radio Graphic Level Recorder, Model 1521A.
4. Sennheiser headphones for monitoring sound level meter and tape recorder signals.

HIGHWAY NOISE CRITERIA

The noise criteria formally applicable to this study are contained in the Federal Highway Administration's "Procedures for Abatement of Highway Traffic Noise and Construction Noise".⁶ These standards specify various design noise level limits for highway noise during the noisiest traffic hour in areas occupied or used by people. The outdoor noise limit is L_{10} of 70 dB(A) for virtually all types of land use except especially quiet parks [60 dB(A)] and for industrial uses [75 dB(A)]. In this study the 70 dB(A) criterion applies to most of the existing and planned land uses. Violations of the criteria require the consideration of methods for reducing the highway noise to meet the criteria.

The state of the art in setting environmental noise criteria is far from arriving at a quantity to define the dividing line between acceptable and unacceptable noise levels. Various aspects of noise bother people, to different extents, for example, interference with speech communication including listening to home entertainment equipment, loss of sleep, neurotic effects of being startled, etc.

This study is based on the L_{10} level during the peak traffic hour which occurs during the weekday afternoon homebound traffic flow. The limit of 70 dB(A) can be considered reasonable for urban areas since it lies near the median noise value for densely populated areas.³

TABLE I - EXAMPLES OF COMMON NOISE LEVELS

Rock and Roll Band (Indoors) -----	100-115 dB(A)
DC-9 Jet Plane at 6000 ft., Before Landing -----	97 dB(A)
Tractor Trailer Truck at 50 ft., 55 MPH, Steady Speed -----	85 dB(A)
Possibility of Permanent Hearing Loss, 8 Hours a Day or Equal --	85 dB(A)
Automobile, at 50 ft., 65 MPH -----	73 dB(A)
Normal Conversation, at 3 ft. -----	60 dB(A)
Urban Daytime Ambient Noise, Without Nearby Loud Vehicles ---	60-70 dB(A)
Suburban Daytime Ambient Noise, Without Predominant Loud Sources -----	40-50 dB(A)
Inside Quiet Home -----	35-45 dB(A)
Rural Area, With Little or No Wind -----	30-40 dB(A)
Threshold of Hearing (Varies with Age, Occupation, Etc.) -----	0-10 dB(A)

Note: The given values are typical. For non-steady conditions the values represent the maximum noise level during the event.

TABLE II - EXISTING AMBIENT NOISE LEVELS
IN CHARLESTOWN DURING WEEKDAY RUSH HOUR PERIODS

Location	Year	Measured Noise Level dB(A)		Principal Sources
		L ₁₀	L ₅₀	
Water St./Foss St.	'72	75	69	HW, L
Off Ramp/Wapping St.	'72	74	67	HW
*	'75	71	69	HW
Shipyard - Bldg. 24	'75	70	64	Yard Activities
Shipyard - Commandant's House	'75	69	66	HW
Shipyard - Gate 5/5th Ave.	'75	71	68	HW
YMCA/City Square	'72	76	70	L, HW
On/Off Ramp/Henley St.	'72	84	75	HW, L
Winthrop Sq./Adams St.	'72	73	66	L, HW
Chestnut St./Adams St.	'72	75	66	HW, L
58 Chestnut St.	'72	64	58	L
Prospect St./Edgeworth St.	'72	66	63.5	HW, C, L
*	'75	66	64	HW, L
Lowney Way/Tremont St.	'72	81	75	HW, L
*	'75	77	73	HW, L
Monument Sq./Tremont St.	'72	63.5	58	L, C
*	'75	62	56.5	L, C
Bunker Hill St./Tufts St.	'72	72	68	L
Vine St./Hunter St.	'72	75	70	HW, L
*	'75	72	69	HW, L
Barry Playground	'75	70	68	HW
Medford St./High School Site	'75	70	64	L

* = Comparison site to test validity of 1972 data for 1975 conditions

HW = Limited Access Highway and Ramp

L = Local Street

C = Children/Pedestrians

SELECTION OF BASIC METHOD

The overall noise impact of the proposed highway alternatives will be determined from noise levels predicted for specific receptors in the study area. The computational effort for traffic noise predictions can be expended either on a large number of evenly distributed receptor points from which one develops contours of constant noise level or on a small number of receptor points having particular significance to the study. In the latter case much greater attention can be paid to the physical details of each specific receptor. This approach, being more precise, is selected for this study, particularly because the magnitude of changes in the total noise are expected to be quite small for a majority of the receptors. The noise levels will be predicted for each alternative including the "no-build" cases for the current time frame (1975-76) as well as the 1985 and 1995 periods for which traffic predictions have been developed.

Predicted noise levels for this study are determined by accepted methods, which have been thoroughly calibrated against empirical noise data.^{2,3} These latter methods have been adapted by a number of federal and state agencies, and research organizations for digital computer processing, which is most efficient for computing traffic noise at a large number of receptors, e.g., constant noise level contours for large scale highways.

COMPUTATIONAL MODIFICATION AND ADJUSTMENTS UTILIZED IN THIS STUDY

The prediction of traffic noise requires basic information such as volume, speed, and distance. Secondary adjustments may be required for gradients, traffic signals, and barriers. In urban situations such as Charlestown the principal contribution to the L_{10} noise level are trucks. The most difficult task involves the combination of multiple sources, i.e., two or more roadway segments contributing significantly to the total L_{10} value at a given receptor location.

The following basic assumptions and adjustments to the calculations were made:

1. Except as noted below all observers are at ground level; unless there are barriers the noise level at the second or third story level will be essentially the same as at grade.
2. Barrier effect calculations place the observer elevation at six feet above grade while the source is located eight feet above grade to account for exhaust pipe location of typical heavy trucks.
3. Observers are always located at least 25 feet from local arterial sources to account for the typical

distance between the building facade and the center line of the arterial.

4. No barrier value is given to curbs and low parapets on the elevated sections of the Tobin Bridge and Fitzgerald Expressway because trucks extend above such barriers while drain openings allow tire noise to "leak out" below the barrier.
5. In computations using projected traffic volumes, trucks include all heavy and one third of all light and medium truck volumes. Two axle, four tire delivery vans and panel trucks below 6000 lbs. GVW have noise characteristics similar to cars.
6. The combination of L_{10} values is based on the energy summation method acceptable by FHWA, although there is reason to believe that the statistical nature of such a sum is not the same as that of the components. Although the summation technique tends to overestimate the resultant L_{10} level slightly, its convenience and consistency justifies its use.
7. The source level of traffic on the lower roadway of the double decked section of the Tobin Bridge was increased 1 dB to account for reflections from the upper deck.
8. Barrier effects of buildings were not applied to highway noise level predictions, particularly since the local street traffic represents the principal source of noise at those observer locations.

SELECTED NOISE RECEPTORS

The receptor points selected for evaluation in this study are distributed in a band parallel to and at various distances from the Tobin Bridge as well as at isolated critical points throughout the study area, such as housing projects, tourist attractions and community focal points. The receptors and their elevations and distances to the edges of significant sources of traffic noise are listed in Table III.

Receptors in the Shipyard may be exposed to additional internal traffic noise depending on the ultimate utilization of the facilities. These potential sources are, of course, undefined at this point. Only the predicted traffic through Gate No. 5 in the 1995/build alternatives is certain to affect Receptor No. 5.

NOISE IMPACT ASSESSMENT

The computed traffic noise levels expressed as L_{10} dB(A) are plotted in Figures 2 through 6. Figure 2 describes current peak hour traffic noise. Two receptor sites, Monument Square and Winthrop Square, are located well away

TABLE IV - MEASURED AMBIENT AND PREDICTED TRAFFIC NOISE
LEVELS FOR PEAK HOUR TRAFFIC ON WEEKDAYS AT SIXTEEN RECEPTORS.
NO-BUILD ALTERNATIVE L₁₀ dB(A).

Receptor	Measured 1972 and 1975	Predicted		
		1975	1985	1995
1. Shipyard, Gate 1	- ¹	69	69	70
2. Shipyard, Bldg. 24	70	62	62	63 ³
3. Shipyard, Commandant's House	69	74	74	74
4. Shipyard, 4th Ave. and 9th St.	-	71	71	71 ³
5. Shipyard, 5th Ave. near Gate 5	71	70	70	70 ³
6. Lowney Way at Tremont St.	77	79	79	82
7. Prospect St. and Edgeworth St.	66	66	66	67
8. Kent School (New)	-	77	77	78
9. Decatur St. at Sm'l Morse Way	-	75	75	75
10. Barry Playground	70	72	72	72
11. Medford St. at Tufts St.	-	77	77	77
12. Medford St./High School Site	70	77	77	77
13. Bunker Hill St. at Lexington St.	-	77	77	77
14. Monument Sq. at Tremont St.	62	68 ²	68.5 ²	69 ²
15. Winthrop Sq./Adams St.	73	68 ²	68.5 ²	69 ²
16. City Square	76	87	87	87

1 - blank indicates no data obtained for receptor location

2 - estimated value used for lack of local street traffic data

3 - does not include effects of traffic within shipyard

from all major arterials, and since no local traffic volumes predictions are available the estimated values based on population density as described in the introductory section are utilized. Figures 3 and 4 provide the projected noise values for the no-build conditions in 1985 and 1995. Figures 5 and 6 provide the results for the build conditions for these years. Since only two of the sixteen receptors were found to be influenced differentially by the build alternatives, the noise levels for all four alternatives are also shown in Figures 5 and 6. The numerical results plotted in Figures 2 through 6 are summarized in Tables IV and V to facilitate direct comparisons among the various conditions.

SUMMARY

NO-BUILD CONDITIONS

1985 - Noise levels are unchanged because truck traffic increases only slightly compared to 1975.

1995 - The anticipated intensive utilization of the Shipyard will increase the truck volumes on Lowney Way and the BHA playground loop with a corresponding small increase of 1 to 3 dB in noise along this route compared to 1975/85.

BUILD CONDITIONS

1985 - Diversion of trucks from Lowney Way and the loop around the BHA playground will offer up to 3 dB noise reduction in adjacent areas such as the Kent School. Noise along eastern Medford Street will also drop 4 dB relative to no-build condition as a result of fewer anticipated trucks. Traffic volumes across the new Little Mystic Bridge are in all cases too low to affect any of the receptors selected for analysis.

1995 - Virtually no significant increases in noise levels are anticipated in the residential areas since local car and truck traffic volumes are expected to remain nearly the same as in 1985. The increased traffic to and from the Shipyard will contain a relatively small proportion of trucks, hence noise in the areas directly adjacent to the Water Street to Chelsea Street connector will not change very much. Except for Alternative 4, which displaces stop and go traffic, Tobin Bridge traffic noise will continue its general dominance over most of the receptors in this corridor. The noise levels at Receptor 3, the Commandant's house, include the noise blocking benefit of the historic wall since all calculations are based on ground level (standing head height) observer elevations. Noise at Receptor 1, the gate to the National Park area is influenced by the distance to the nearest ramp in each Alternative, particularly for the 1995 projected traffic volumes.

TABLE V - PREDICTED TRAFFIC NOISE LEVELS FOR PEAK HOUR
TRAFFIC ON WEEKDAYS AT SIXTEEN RECEPTORS.
BUILD ALTERNATIVES, L₁₀ dB) A)

Receptor	Alternative	1985	1995
1. Shipyard, Gate 1	2	70	73
	2A	72	76
	3	73	78
	4	73	79
2. Shipyard, Bldg. 24	ALL	62 ²	63 ²
3. Shipyard, Commandant's house	2	75	75
	2A	75	75
	3	75	75
	4	75	77
4. Shipyard, 4th Ave. and 9th St.	ALL	71 ²	72 ²
5. Shipyard, 5th Ave. near Gate 5	ALL	70 ²	70 ²
6. Lowney Way at Tremont St.	ALL	78	78
7. Prospect St. and Edgeworth St.	ALL	66	66
8. Kent School (New)	ALL	74	74
9. Decatur St. at Sm'l Morse Way	ALL	75	76
10. Barry Playground	ALL	72	72
11. Medford St. at Tufts St.	ALL	73	73
12. Medford St./High School Site	ALL	73	73
13. Bunker Hill St. at Lexington St.	ALL	74	74
14. Monument Sq. at Tremont St.	ALL	68.5 ¹	69 ¹
15. Winthrop Sq./Adams St.	ALL	68.5 ¹	69 ¹
16. City Square	ALL	87	87

1 - estimated value used for lack of local street traffic data

2 - does not include effects of traffic within shipyard

NIGHTTIME NOISE

Nighttime traffic data were available for only the Tobin Bridge for which the current weekday volume of noisy truck is nearly constant at around 30 per hour in each direction between 5:30 p.m. and 4:30 a.m. Trucks represent an average of about 10 percent of the combined vehicle volume during this period, about double the percentage of trucks during the peak daytime period for which noise projections were computed. Nevertheless, the reduction in hourly L_{10} for receptors up to 200 ft. from the Bridge is expected to be about 7 dB relative to the daytime rush hour value. This decrease also applies to all alternatives in 1985 and 1995 since the Tobin Bridge traffic is not projected to change significantly over this period and because local truck traffic volumes at night are probably not going to be significant.

CONSTRUCTION NOISE

At present, construction equipment noise has not come under federal regulation, except for portable air compressors effective 1978, hence current fairly loud equipment noise levels can be assumed representative of construction equipment to be used in the proposed construction. Noise level range roughly from 80 to 90 dB(A) at 50 ft. Practical control of construction noise is limited to (a) scheduling the noisiest operations such as use of jack-hammers and pile drivers, during periods of rush hour traffic and when people are likely to be least disturbed by noise; (b) checking equipment for proper mufflers and proper maintenance of other noise reducing devices; (c) locating any stationary noise generating equipment such as generators, compressors and pumps as far as possible from noise sensitive areas. Most of the construction will be taking place on the currently less sensitive side of the Tobin Bridge, hence the construction noise will be partially masked by general traffic noise. Truck detours resulting from temporary re-routing due to the construction may produce added impact, particularly if these routes were to include streets that presently carry little truck traffic. Such conditions should be minimized. Existing truck routes should be used as much as possible.

VIBRATIONS IN NEARBY BUILDINGS

Large vehicles passing over expansion joints, potholes and uneven pavement surfaces will create roadway vibrations. These vibrations are most obvious for elevated structures in which deck vibrations readily produce sound waves. Vibrations may also be felt in buildings close to a roadway. The more common indicator of uneven road surfaces is, however, the airborne noise from "bouncing" tires and the rattling of components such as tailgate hardware, and large flexible side panels of truck trailers. Highway vibrations, per se, are generally not of sufficient amplitude even at close proximity between pavement and building

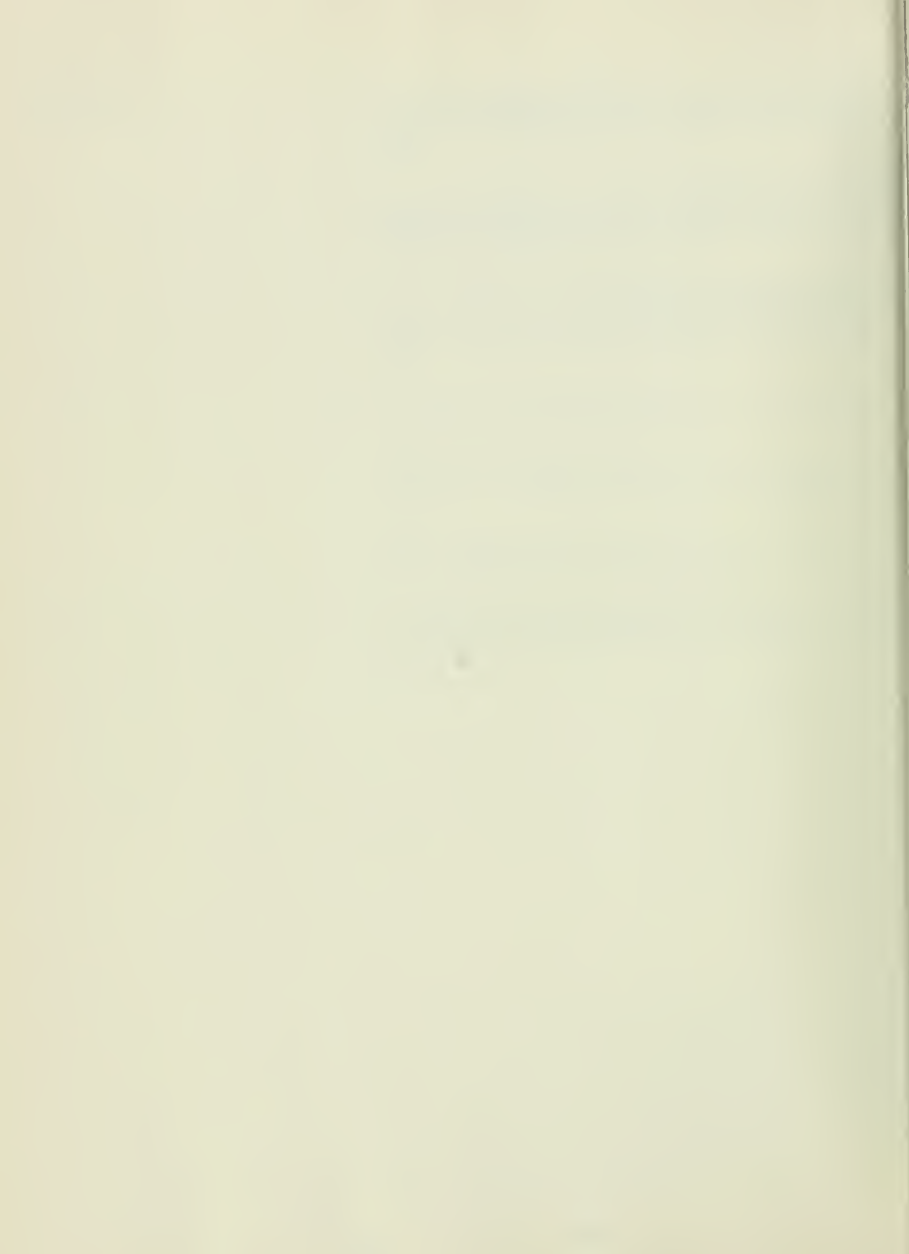
foundation, say 2 ft., to equal the threshold for damaging vibrations.⁷ Thus, there should be no concern whatsoever for structural damage at the Commandant's house (Receptor 3) from either Tobin Bridge or Chelsea-Water Street Connector truck traffic. One final comment on this subject is that low frequency exhaust noise emission of large vehicles often excites natural resonances of rooms, building components, and "contents". Common examples of this phenomenon are rattling of poorly fitting windows, or glasses in a cupboard, that barely touch, tinkling against one another when a noisy truck or aircraft passes. The energy that excites these vibrations is, of course, strictly transmitted through the air and even though it produces acoustical effects that could just as easily be produced by ground borne vibrations, it can not be controlled by any method of isolating of the roadway vibrations from the building. Thus, while some people living near highways believe their houses are subjected to severe roadway vibrations, low frequency sounds produced by vibrating roadway decks and trailer side walls, and higher pitched sounds of rattling vehicle parts are the sources of their concern.

GENERAL

The modest change in overall noise level in Charlestown predicted by these calculations for the build alternatives is not too surprising. The slight improvement expected in several specific areas is balanced by an overall increase in traffic flow and higher noise in presently less critical land use areas along the Tobin Bridge, on the Shipyard side. The design goal of $L_{10} = 70$ dB(A) is exceeded along all major arterials and the Tobin Bridge corridor. No significant reduction in the noise impact on Charlestown, either overall or on specific streets, can be expected under the projected increases in traffic and population unless a drastic change in one or more parameters of traffic noise occurs. Possible measures might include enforceable truck exclusions from noise sensitive land use areas and deeply depressed local truck routes.

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Water Quality

criteria

The following criteria are used for the evaluation of water quality impacts. The standards for the listed factors have been applied to the Little Mystic Channel's existing condition, and its projected future condition as a result of building the proposed bridge.

Biochemical Oxygen Demand (BOD)

BOD is the amount of oxygen consumed by bacteria in the breakdown of organic wastes. The origins of BOD are those of any bio-degradable organic matter: domestic and industrial wastes; urban and agricultural runoff; dead and decaying algae; etc. BOD of untreated municipal sewage is commonly 100-200 mg/l. BOD levels are normally expressed in terms of the oxygen consumed over a specified period of time, e.g., 5 or 20 days.

Note: numbered references in parentheses refer to bibliography

Chemical Oxygen Demand (COD)

COD is the total oxygen demand of organic and inorganic materials present in the water, including those not readily broken down or oxidized by bacterial action. Sources are the same as those for BOD, as well as a variety of toxic or slowly degradable industrial wastes. COD levels for municipal wastes are typically 3-6 times higher than BOD levels, for industrial wastes the ratio is frequently much higher. COD may be loosely thought of as the ultimate oxygen demand which may be exerted on the water, while BOD better indicates the rate at which the demand will be exerted.

Dissolved Oxygen (DO)

Oxygen, in water as in air, is the essential element for support of healthy aquatic life. Most game fish require 4-5 mg/l of DO to survive. Since natural waters can contain a maximum of only 8-9 mg/l DO, the tolerances for oxygen depletion are low. Oxygen enters the water from the atmosphere (aeration) and from aquatic plant growth (photosynthesis). It is removed by chemical and biochemical oxidation of organic wastes (COD and the BOD)

and by the metabolism of all the aquatic animals present in the aquatic environment.

Temperature

All phases of aquatic life: species present; reproduction; growth; activity; rates of metabolism; etc., are affected by changes of temperature. The most desirable game fish, for example, begin to experience stress above 58°F. As temperature increases, the rate of oxygen depletion (BOD) increases, but the maximum available dissolved oxygen unfortunately decreases. Temperature increases in natural waters result principally from cooling water discharges from a variety of industries, from agricultural (irrigation) return waters, and from vegetation cutting, or shade removal, along the streams banks.

Phosphorus (P)

Phosphorus enters waterways in a variety of forms, both organic and inorganic, from domestic and industrial wastes, urban and agricultural runoff, and even in rainfall. Phosphorus is an essential fertilizing element and very small quantities can produce potentially prolific plant growths. Concentrations greater than 0.05 mg/l, for example, will generally result in aesthetically displeasing growths (called "blooms") of algae or aquatic weeds in natural waters. Phosphorus concentrations of 0.08 mg/l have been measured in rain water. Typical treated sewage effluents will contain about 10 mg./l.

Nitrogen (N)

Nitrogen is another crucial plant, or algae, growth nutrient. It may enter waterways as organic proteinaceous material, as ammonia or ammonium compound, nitrites, nitrates or at waterfalls or dams as dissolved nitrogen gas from the atmosphere. In the presence of trace quantities of phosphorus, nitrogen concentrations as low as 0.3 mg/l are frequently adequate to generate offensive plant growth or algae blooms.

Ammonia Nitrogen is present in sewage and is also generated from the decomposition of organic nitrogen. It can also be formed when nitrites and nitrates are reduced. Ammonia is particularly important since it has high

oxygen and chemical demands and is also toxic to fish.

Nitrite Nitrogen is the immediate oxidation product of ammonia. It has a fairly low oxygen demand and is rapidly converted to nitrate. The presence of nitrite nitrogen usually indicates that active decomposition is taking place.

Nitrate Nitrogen is important since it is the end product in the aerobic decomposition of nitrogenous matter. Nitrogen in this form is readily available to plants.

Kjeldahl Nitrogen is the total organic nitrogen plus ammonia.

pH

pH is a measure of the acid or alkaline content of water. Technically, pH is the "negative logarithm of hydrogen ion concentration". pH 7 is neutral; pH less than 7 is acid; pH greater than 7 is alkaline, or basic. Most desirable aquatic organisms survive within only a relatively narrow band of pH values, say pH 6.5-8.3. The pH of natural waters is reduced by any discharge of acid wastes; it is increased by a discharge of alkaline or caustic wastes.

Hardness

Hardness in water is the concentration of the two elements; calcium and magnesium. It is often expressed in terms of the equivalent concentration of calcium carbonate (CaCO_3). Hardness of natural waters varies greatly with geography; the mid-western U.S. having generally "hard" waters (greater than 150 mg/l CaCO_3) and the Northeast and Northwest having generally "soft" waters (less than 100 mg/l CaCO_3). Since the solubilities of both calcium and magnesium decrease rapidly with increasing temperature and pH, hardness produces scale in boilers and cooling water systems. It also precipitates soaps, making many cleaning operations more difficult. Hardness in natural waters has the beneficial effect of rendering many heavy metals less toxic.

Coliform Bacteria

The coliform group comprises all the aerobic and facultative anaerobic, gram negative, non-sporeforming, rod shaped bacteria which ferment lactose and produce gas. Coliform bacteria can be found in almost any environment. Their metabolism is similar to pathogenic bacteria thus they are used as indicators of possible pathogenic contamination. A concentration of less than 1000 organisms per 100 mls is the normally accepted limit for swimming quality water. Fecal coliforms are indigenous to the intestinal tract of warm blood animals and are used as an indicator of sewage wastes in water. It is generally recommended that fecal coliform should not exceed 1000 organisms per 100 mls for swimming quality water.

Solids

Total Solids are all the materials present in natural waters other than pure H₂O and dissolved gases. One use-cycle of water, i.e., from a river, through a municipality and back to the river as waste, will typically increase the total solids by about 600 mg/l.

Dissolved Solids are those solids not removed by settling or filtration. One municipal use-cycle will typically increase dissolved solids by about 400 mg/l. U.S. Public Health Service drinking water standards recommend a limit of 500 mg/l for drinking water supplies.

Suspended Solids are those solids removed by salting or filtration. Suspended solids are colloidal or larger sized and consist of inorganic precipitates, clays, silt, bacteria, algae and other organic particulates. Suspended solids above 100 mg/l affect breathing of many game-fish.

Volatile Suspended Solids are the organic fraction of the suspended solids and include algae, bacteria, detritus and organic colloids

In a sense, the solids contents of natural waters are an indication of the waters' usage, since virtually every use; domestic; industrial; agricultural; tends to increase solids content.

Turbidity

Turbidity is a measure of the light scattered by materials (solids, gases or other liquids) suspended in water. Water appears cloudy because of light scattered by suspended particles. Along with other deleterious effects of suspended solids in natural waters, aesthetic values are lessened because of the resulting turbid appearance. A simple measurement of turbidity in many cases will provide a reasonable estimate of the suspended solids concentration in natural waters.

Color

Natural waters become colored by metallic compounds, principally iron, and by the products of natural vegetative decay - humic acids, tannin and lignin complexes. Suspended materials, notably algae, also result in an apparent, though not a "true" color. Waste waters from a great many industrial processes add color to receiving waters. While color is principally an aesthetic concern, many color producing materials (principally industrial) represent toxic and other hazards far more significant than their contribution to color.

Heavy Metals

Some of the metals commonly discharged to natural waters include cadmium, chromium, copper, iron, lead, manganese, mercury and zinc. All of these metals are toxic to aquatic life at very low concentrations. Heavy metal toxicities, however, vary considerably with pH, dissolved oxygen, hardness and temperature. The following are offered as general fish life tolerance levels:

Cadmium	- 0.05 mg/l
Chromium	- 0.05 mg/l
Copper	- 0.02 mg/l
Iron	- 0.02 mg/l
Lead	- 0.1 mg/l
Manganese	- 1.0 mg/l
Mercury	- 0.05 mg/l
Zinc	- 0.1 mg/l

The toxicities of individual metals, moreover, are synergistic with each other; small traces of copper, for example, greatly magnifying the toxicity of other metals. As a general

guideline, the total concentration of all heavy metals should not exceed 1.0 mg/l.

Oil

Petroleum hydrocarbons have been shown to have wide ranging deleterious effects on the aquatic environment. Refined oils are more harmful than crude oil. Oil has been shown to cause death to fish, shellfish, algae, vascular plants, and many other types of aquatic animals. It is recommended that oil not exceed 15 parts per million in water and that there should be no visible oil slicks on water surfaces.

Benthic Fauna

Bottom dwelling organisms, because they are normally long lived, can be used to determine long-term water quality. Typically, clean marine waters will have a large variety of species living on the bottom. Limpets, crepidulas, sponges, starfish, clams, and brittle-stars should be common. A bottom with sludge and silt deposits normally exhibits large populations of marine annelid worms. Habitats with populations densities of over 200 organisms per square foot are considered to be overenriched.

Aquatic Fauna

Waters which contain high concentrations of contaminants will usually create stress conditions for marine animals. The earliest sign of stress is usually avoidance reactions. Therefore, when animals are not found in certain areas but are known to be indigenous to that area it can be assumed that conditions are not favorable to that species.

Aquatic Flora

Algae and aquatic vascular plants when found in large concentrations signify overenrichment of the water. Concentrations over 10,000 cells are considered to be algae blooms and are indicative of overenrichment.

existing water
quality

Most of the data used in this assessment obtained from previous studies by or for the Massachusetts Division of Water Pollution

Control, U.S. Environmental Protection Agency, New England Aquarium, and Marine Environmental Services. Other data was obtained by personal communication and direct observation. This information was then used to make calculations and projections.

The Little Mystic Channel is approximately 1005 meters (3300 feet) long and has an average width of about 96 meters (315 feet). Total surface area of the water is 97,000 square meters (1.05×10^6 square feet). Water depth ranges from 0-10.6 meters (0-35 ft.) and has an average depth of 6.5 meters (21 ft.) at mean low water. Total volume is about 630,000 cubic meters (1.67×10^8 gal.). The average tidal excursion is 2.9 meters (9.5 ft.) and flushes 281,000 cubic meters (7.4×10^7 gal.) of water per tidal cycle.

According to the U.S. Coast Guard⁽¹⁾, no information is available on the currents in the channel. It can be assumed that they are proportionally lower than the currents in the Inner Harbor at the mouth of the channel. The velocities and directions of spring currents in the Inner Harbor are shown in Appendix D, Table 1.⁽²⁾

Sources of Pollution. There are six point sources of pollution which flow into the Little Mystic Channel (Appendix D, Figure 1). There is one combined sewer overflow at the end of Chelsea Street and two storm water outlets, one located at the southwestern tip of the channel and one off Country Way. Existing data for the combined sewer overflow and the estimated discharges from the storm sewer outlet are summarized in Appendix D, Table 2.

Urban stormwater runoff typically contains substantial amounts of pollutants, which can contribute to a variety of problems, including pollution of receiving waters, overloading of sewage treatment plants and decreased efficiency of sewer systems. Sources of pollutants are debris and contaminants from streets, dirt and debris from open areas, publicly used chemicals, air-deposited substances, ice control salts, and dirt and contaminants washed off or emitted from vehicles. Calculations, based on available data, show that storm water runoff from separated storm system drainage area will annually discharge 6300 lb of BOD₅;

40,000 lb of COD; 117,000 lb suspended solids; 380 lb total phosphorus; 1400 lb total nitrogen; and 9×10^{14} coliform bacteria to the channel.

Inspection of the combined sewer overflow at the corner of Chelsea and Medford Streets showed that the regulator and tidegates were not operating properly. Still it was apparent that dry weather flow was properly directed to the MDC sewer system. The chemical analysis of the combined sewer overflow does not demonstrate the significance of overflows after storm events. Salinity measurements indicate that these were dry weather flows and that nearly all of the flow was sea water which had infiltrated into the pipe at high tide. Discharges after storm events are expected to contain substantially higher concentrations of pollutants. Typical combined sewer overflow discharges contain 5×10^6 total coliform bacteria per 100 ml; 410 mg/l suspended solids; 4 mg/l phosphorus; 10 mg/l of total kjeldahl nitrogen; 115 mg/l of BOD₅. Yearly loadings from combined sewer overflows were not calculated.

There are two street and parking lot drains which are located at the entrance to the Mass. Port facility. These drain into the north side of the channel under the Tobin Bridge. No chemical analysis has been done on the effluent but foam has been observed flowing from one of them. The other point source is the cooling water discharge from the Charlestown Naval Shipyard power plant. The discharge permit is for 12 million gallons per day but the present flow is 450,000 gallons per day. Chemical analysis of the discharge is unavailable but the power plant foreman states that the only change from the raw water input from the Inner Harbor is that the temperature is raised about 5.5°C (10°F). (5)

Sources of non-point pollution are the drainage area on the north side of the channel, and the Barry Playground, all of the remaining drainage area is sewered. The non-sewered area is 12 acres. Based on an average annual rainfall of 45 inches, it is estimated that annual pollutant loadings are approximately 860 lb of BOD₅; 5400 lb of COD; 16,000 lb of suspended solids; 51 lb of total phosphorus; 190 lb of total Nitrogen; and 1.3×10^{12} coliform organisms.

Water Quality Analysis. Water quality has not been studied firsthand in the channel. Because there is no large influx of water other than that from tidal variation, water quality can be assumed to be very similar to that in the Inner Harbor. The Massachusetts Division of Water Pollution Control examined water quality in the Inner Harbor in 1972⁽³⁾. This study showed that these waters cannot meet the State's SC classification⁽⁶⁾ (Appendix D, Table 4) assigned to them because the average dissolved oxygen (DO) is less than 5.0 mg/l. The five day biological oxygen demand (BOD₅) is not excessively high and oxygen depletion cannot be attributed to BOD₅ alone. The most probable cause for low DO is the combination of BOD₅, chemical oxygen demand (COD), and the benthic load resulting from organic mud and sludge deposits. No information is available on COD or benthic load. The high coliform counts indicate the presence of raw sewage. Concentrations of 0.15 mg/l of phosphorus, and 1.2 mg/l of total nitrogen are sufficiently high to support algae blooms. Color and turbidity are not sufficiently high to be harmful to aquatic organisms.

The New England Aquarium studied heavy metals in the Inner Harbor in 1972⁽⁸⁾. It was found that concentrations of soluble and particulate heavy metals exceeded normal oceanic levels but they were well within the maximum concentrations recommended by the U.S. Environmental Protection Agency⁽⁹⁾ (Appendix D, Table 5).

Benthic Environment. Observation of the channel at low tide reveals what seems to be an unhealthy benthic environment. The bottom around the edge of the channel is covered with trash and most of the pilings are rotted. Most of the bottom seems to be composed of a fine dark clayey silt.

The littoral benthic community, especially soft-shell clams (*Mya arenaria*) and mussels (*Mytilus edulis*), is living under stress conditions. The bottom, in the area of the two clam beds is sandy gravel which is saturated with oil to a depth of over six inches. Clams and mussels seem to exhibit a high mortality rate as is evidenced by the large number of empty immature shells. A typical healthy clam flat should have additional animal species such as Green crabs, Tellin

shells, blood worms, clam worms, and oyster drills associated with it. None of these were observed in the channel. In other areas of the littoral zone, the dominant animal species are mussels and barnacles (Balanus sp.) which are found on rocks and pilings.

It is expected that deeper waters will exhibit a benthic community similar to that of the Inner Harbor. The dominant fauna are probably the marine annelid worms, which are "pollution tolerant" organisms. They thrive in highly organic muds and are found throughout Boston Harbor. The sand shrimp should also be common. A healthy benthic community would be expected to exhibit more diversity and contain starfish, limpets, snails and sponges.

Heavy metal analysis of the channel sediments, near the combined sewer outfalls, indicates deposition of metals in the channel has occurred at a slower rate than in the Inner Harbor⁽³⁾, but at a much higher rate than would be expected from a relatively clean estuary such as the North River in Scituate, Massachusetts. (Appendix D, Table 6). The fate of these metals in sediment is not wholly known but it has been shown that they can be released from the interstitial water into the environment where they could be bioaccumulated in organisms and passed up the food chain. They could eventually reach toxic or even lethan levels to organisms.

Aquatic Environment. There are 21 species of finfish that can be expected to be found in the channel (Appendix D, Table 7). The dominant species would be winter flounder which would be found year-round. The second most common species would be rainbow smelt which would be found during the early spring. Herri would be prevalent in springtime and alewife in the early summer.

The dominant phytoplankton in the channel should be diatoms and green algae. Phytoplankton concentrations can reach over one million cells per liter during spring bloom. This indicates a moderately but not excessively rich or eutrophic water body.

Invertebrates inhabiting the channel should be the same as those found in the lower Mystic



Figure G1

Little Mystic Channel Point Sources and Sampling Sites

Chelsea - Water Streets Connector • Little Mystic Channel Crossing
Draft Environmental Impact Assessment

Street Drain Outlets

Storm Sewer Outlets

Combined Sewer Overflow

Cooling Water Outlet

Sediment Sampling Site



River. At least twenty two species of invertebrates have been identified in the water of the lower Mystic River, near the channel(10), with the Copepods the dominant species.

Table IX.D-1

Spring Velocities and Direction of Current²

	<u>Speed in Knots</u>	<u>Direction</u>
1/2 hour after low water	0.2	ebb
1-1/2 hours after low water	0.1	flood
2-1/2 hours after low water	0.3	flood
3-1/2 hours after low water	0.4	flood
4-1/2 hours after low water	0.4	flood
5-1/2 hours after low water	0.3	flood
High water	0.1	flood
1 hour after high water	0.2	ebb
2 hours after high water	0.4	ebb
3 hours after high water	0.6	ebb
4 hours after high water	0.7	ebb
5 hours after high water	0.6	ebb

NOTE: All times are in relation to the tide at Deer Island Light.

²U.S. Coast and Geodetic Survey, 1973.

Table IX.D-2

Discharge from the Combined Sewer Overflow⁽³⁾ at Chelsea Street
and Estimated Discharge from Storm Sewer⁽¹⁶⁾

	Storm Sewer Mean	Combined Sewer Overflow	
		Range	Arithmetic Mean (5 Samples)
Temperature (°C)		22	22
Dissolved Oxygen (mg/L)		5.4-12.2	8.2
Biological Oxygen Demand (mg/L)	19	2.4-6.8	4.2
pH	7.5	6.8-8.0	7.5
Total Coliform (MPN/100 ml)	58,000	910-460,000	106,000
Fecal Coliform (MPN/100 ml)	10,900	91-93,000	28,000
Suspended Solids (mg/L)	210	0-11	3.6
Color (S.U.)	81	22-65	40
Turbidity (JTU)	170	1-2	1.5
Total Alkalinity (mg/L)	59	65-110	88
Chlorides (mg/L)	12	7,400-15,600	12,300
Salinity (g/L)		13.6-28.7	22.6
Total Phosphorus (mg/L)	0.8	0.12-0.22	0.15
Total Kjeldahl Nitrogen (mg/L)	2.3	0.8-1.5	1.2
Ammonia-Nitrogen (mg/L)	0.6	0.05-0.39	0.2
Nitrate-Nitrogen (mg/L)	0.4	---	---

NOTE: These samples were not flow proportional

⁽³⁾ Massachusetts Division of Water Pollution Control, 1973.

⁽¹⁶⁾ Weibel, et.al.

Table IX.D-3

COMPOSITE WATER QUALITY
BOSTON INNER HARBOR JUNE-NOVEMBER 1972³
AND NORTH RIVER ESTUARY 1970⁷

	INNER HARBOR <u>RANGE</u>	INNER HARBOR ARITHMETIC MEAN <u>(10 SAMPLES)</u>	NORTH RIVER ESTUARY ARITHMETIC MEAN <u>(8 SAMPLES)</u>
Surface Temperature (°C)	5-18*	15	16
Bottom Temperature (°C)	3-14*	-	-
Dissolved Oxygen (mg/L)	2.1-5.7	4.0	8.3
Biological Oxygen Demand (mg/L)	1.1-6.8	2.9	1.7
pH	7.2-8.1	7.5	-
Total Coliform (MPN/100 ml)	930-4.6x10 ⁶	484,000	36
Fecal Coliform (MPN/100 ml)	91-1.5x10 ⁶	149,000	<36
Suspended Solids (mg/L)	15-29	<20	3.4
Color (SU)	15-30	22	16
Turbidity (JTU)	0-8	2.1	0
Total Alkalinity (mg/L)	45-149	108	101
Chlorides (mg/L)	6,400-18,000	14,000	11,900
Salinity (g/L)	11.7-33.1	25.8	21.9
Total Phosphorus (mg/L)	0.1-0.24	0.15	.09
Total Kjeldahl Nitrogen (mg/L)	0.6-1.8	1.2	-
Ammonia-Nitrogen (mg/L)	0.03-0.56	0.27	.45
Nitrate Nitrogen (mg/L)	0-0.1	0.07	-

* Yearly range.

³ Massachusetts Division of Water Pollution Control, 1972
⁷ Massachusetts Division of Water Pollution Control, 1971

Massachusetts Water Quality Criteria⁶

CLASS SC - These waters are suitable for aesthetic enjoyments, for recreational boating, as a habitat for wildlife and common food and game fishes indigenous to the region, and are suitable for certain industrial uses.

WATER QUALITY CRITERIA

<u>Item</u>	<u>Criteria</u>
1. Dissolved oxygen	Not less than 5 mg/l during at least 16 hours of any 24 hour period nor less than 3 mg/l at any time.
2. Sludge deposits-solid refuse-floating solids-oil-grease-scum	None other than of natural origin or those amounts which may result from the discharge from waste treatment facilities providing appropriate treatment. For oil and grease of petroleum origin the maximum allowable concentration is 15 mg/l.
3. Color and turbidity	None in such concentrations that would impair any uses specifically assigned to this class.
4. Total Coliform bacteria	None in such concentrations that would impair any uses specifically assigned to this class. See note.
5. Taste and odor	None in such concentrations that would impair any uses specifically assigned to this class and none that would cause taste and odor in edible fish or shellfish.
6. pH	6.5 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other use.

ItemCriteria

9. Radioactivity

None in such concentrations or combinations in excess of the limits specified by the United States Public Health Service Drinking Water Standards.

NOTE: No bacteria limit has been placed on Class "SC" waters because of the urban runoff and combined sewer problems which have not yet been solved. In waters of this class not subject to urban runoff or combined sewer discharges the bacterial quality of the water should be less than an average of 5,000 coliform bacteria/100 ml during any monthly sampling period. It is the objective of the Division to eliminate all point and non-point sources of pollution and to impose bacterial limits on all waters.

⁶ Massachusetts Division of Water Pollution Control

Table IX.D-5

Heavy Metals in Boston Inner Harbor
1972

	Inner Harbor Sampling Stations ⁷			Naturally Occurring in Marine Waters	EPA Recommended Limit ⁸ (ppb)
	M1	M2	M3		
Cadmium	Soluble 0.53 Particulate N.D.	0.35 N.D.	0.47 N.D.	0.1	10
Copper	Soluble 6.5 Particulate 2.2	4.1 1.4	4.7 2.3	1.0	50
Chromium	Soluble 0.58 Particulate 0.47	0.50 2.1	1.01 1.17	0.4	100
Lead	Soluble 2.5 Particulate 5.3	2.7 5.6	10.6 7.3	0.02	50
Nickel	Soluble 8.3 Particulate 1.2	7.5 2.2	8.7 1.6	5.0	100
Zinc	Soluble 62.2 Particulate 2.6	37.8 2.3	24.7 4.3	2.0	100

NOTE: All values in Parts Per Billion ($\mu\text{g/L}$).

N.D. = Not Determined.

⁸New England Aquarium, 1972⁹National Academy of Sciences, 1972.

Table IX.D-6

Heavy Metals in Little Mystic Channel Sediment³

ELEMENT	END OF CHELSEA ST.	OFF OLD LANDING WAY	INNER HARBOR AVERAGE	NORTH RIVER ESTUARY AVERAGE
Arsenic	10.0	2.6	7.8	1.0
Cadmium	1.3	2.7	6.8	0.45
Copper	82	130	439	8.4
Chromium	54	41	189	13.5
Lead	160	230	443	17.5
Mercury	0.9	2.6	5.7	0.1
Nickel	28	28	72	7.8
Zinc	180	270	1009	28.5
% Volume	4.5	8.0	15.0	-

All values in mg/kg dry weight passing No. 30 sieve.

³Massachusetts Division of Water Pollution Control.

Table IX.D-7

Finfish in Little Mystic Channel

<i>Alosa aestivalis</i>	Blueback herring
<i>Alosa pseudoharengus</i>	Alewife
<i>Anquilla rostrata</i>	American eel
<i>Brevoortia tyrannus</i>	Atlantic menhaden
<i>Clupea harengus</i>	Atlantic herring
<i>Fundulus heteroclitus</i>	Mummichog
<i>Fundulus majalis</i>	Banded killifish
<i>Gadus morhua</i>	Atlantic cod
<i>Macrozoarces americanus</i>	Ocean pout
<i>Menidia menidia</i>	Atlantic silversides
<i>Microgadus tomcod</i>	Tomcod
<i>Morone americana</i>	White perch
<i>Morone saxatilis</i>	Striped bass
<i>Myoxocephalus aeneus</i>	Grubby
<i>Osmerus mordax</i>	Rainbow Smelt
<i>Pollachius virens</i>	Pollack
<i>Pomatomus saltatrix</i>	Bluefish
<i>Pseudopleuronectes americanus</i>	Winter flounder
<i>Scomber scombrus</i>	Mackerel
<i>Tautoglabrus adspersus</i>	Tautog
<i>Urophycis chus</i>	Red hake

Table IX.D-8

Pollutant Loading Rates From Urban Runoff (11)

<u>PARAMETER</u>	<u>LOADING RATE</u> <u>(lb/curb mile/day)</u>	<u>LITTLE MYSTIC CHANNEL</u> <u>DRAINAGE AREA</u> <u>lb/day (lb/yr)</u>	<u>LITTLE MYSTIC CHANNEL</u> <u>DRAINAGE AREA + BRIDGE</u> <u>lb/day (lb/yr)</u>
Total Solids	590	3894 (1,420,000)	3948 (1,440,000)
Volatile Solids	44	290 (106,000)	294 (107,000)
BOD ₅	3.6	23.8 (8,687)	24.1 (8,796)
COD	20	132 (48,180)	134 (48,910)
Kjeldahl Nitrogen	0.6	4.0 (1,460)	4.1 (1,496)
Nitrates	0.019	0.125 (45.6)	.126 (46.0)
Phosphates	0.37	2.44 (891)	2.47 (902)
Total Heavy Metals	1.2	7.9 (2,884)	8.0 (2,920)

(11) Sartor and Boyd

Long Term Effects on Water Quality Particulate Loadings

Using traffic projections from Murray Segal it was calculated that 63% of the vehicles which travel on Terminal Street come from Medford Street via Chelsea Street. The remaining 37% are assumed to come from the west end of Medford Street. Using the general formula:

$$P = D_1 (HE+LE) + D_2 (HE+LE) + D_3 (HE+LE) + D_4 (HE+LE)$$

where: P = Total Particulates in grams per day

D_1 = Distance from corner of Medford and Chelsea St. to corner of Medford and Terminal St. - 1.59 km (.98 mi)

D_2 = Distance from corner of Medford and Terminal St. to end of Terminal St. - 1.89 km (1.17 mi)

D_3 = Distance from corner of Medford and Terminal St. to entrance to Moran Terminal - 0.43 km (0.27 mi)

D_4 = Distance from corner of Medford and Chelsea St. to end of Terminal St. via bridge - 0.97 km (0.57 mi)

H = Number heavy duty vehicles per day

L = Number light duty vehicles per day

E = Exhaust and tire emissions in grams per kilometer
the amount particulates which can be discharged to the channel can be calculated.

1975 Projections

Using the above formula the 1975 daily particulate discharge for the 1740 vehicles using Terminal St. can be calculated as follows:

$$P = 1.59 [263(1.05) + 833(0.67)] + 1.89 [209(1.05) + 661(0.67)] +$$

$$P = 1.59(276 + 558) + 1.89(219 + 442) + .43(219 + 442)$$

$$P = 1326 + 1251 + 285$$

$$P = 2862 \text{ g/day (6.3 lbs/day)}$$

$$P = \frac{5}{7}(365)(2862 \text{ g/day})$$

$$P = 746\text{kg/year (1643 lbs/year)}$$

1985-1995 Loadings

The 1985 and 1995 daily loadings will be the same. Both are based on 1697 vehicles using the bridge, all of which are assumed to proceed east then north on Terminal St., and 1000 vehicles entering Terminal St. from Medford St., 50% of which enter the Moran Terminal and remaining going east on Terminal St. No vehicles are expected to enter Terminal St., from Medford St. via Chelsea St.

Loadings with bridge:

$$P = 0 + 1.89[123(1.05) + 377(0.67)] + 0.43[123(1.05) + 377(0.67)] + 0.91[407(1.05) + 1290(0.67)]$$

$$P = 0 + 1.89(129 + 253) + 0.43(129 + 253) + 0.91(427 + 864)$$

$$P = 0 + 722 + 164 + 1175$$

$$P = 2061\text{g/day (4.54 lbs/day)}$$

$$P = \frac{5}{7}(365)(2061\text{g/day})$$

$$P = 537\text{kg/yr (1184 lb/yr)}$$

Loadings without the bridge would be:

$$P = 1.59[408(1.05) + 1290(0.67)] + 1.89[324(1.05) + 1024(0.67)] + 0.43[324(1.05) + 1024(0.67)] + 0$$

$$P = 1.59(428 + 864) + 1.89(340 + 686) + 0.43(340 + 686)$$

$$P = 2048 + 1939 + 441$$

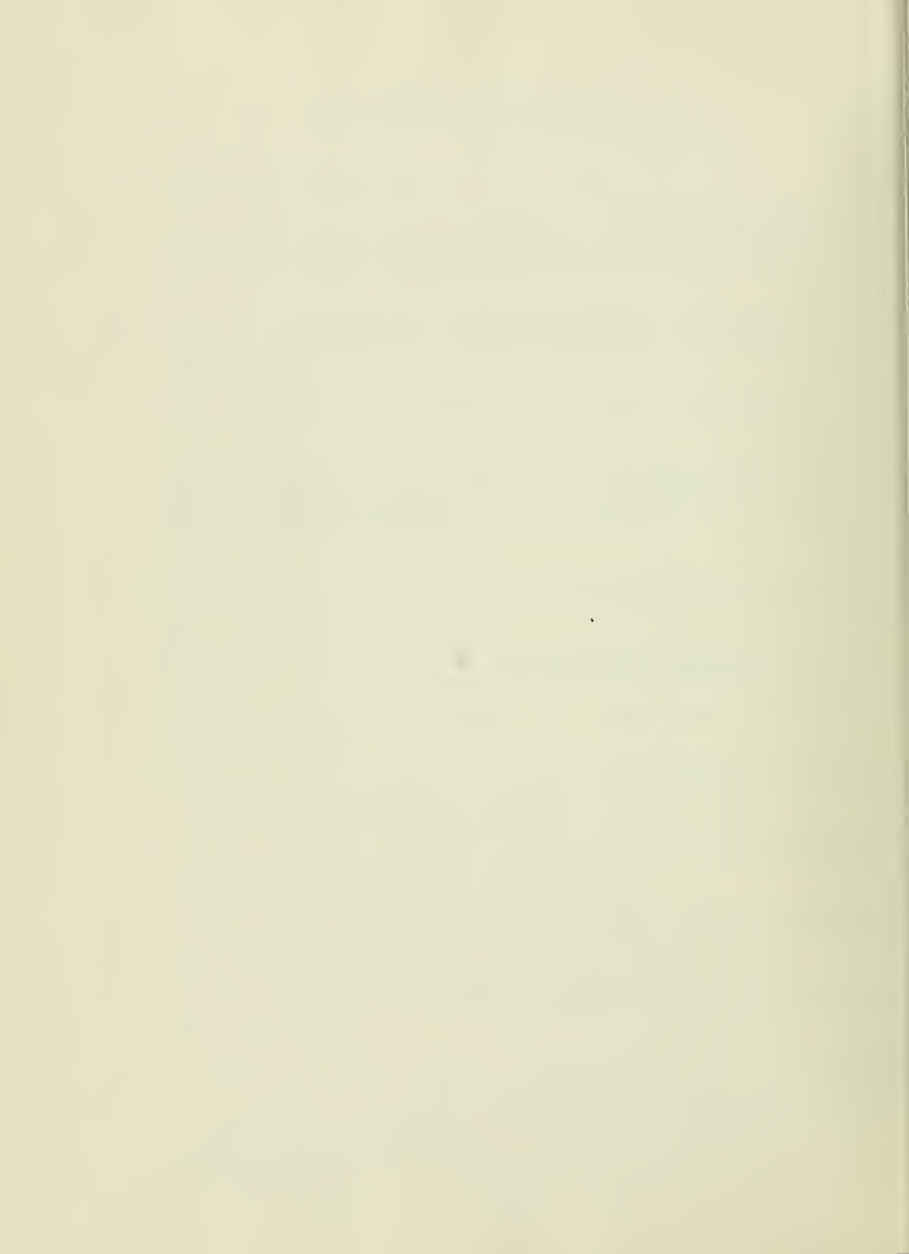
$$P = 4428\text{g/day (9.75 lbs/day)}$$

$$P = \frac{5}{7}(365)(4428\text{g/day})$$

$$P = 1154\text{kg/yr (2542 lbs/yr)}$$

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existing
conditions

Charlestown lost one half of its population between 1950 and 1960. Between 1960 and 1970 the City of Boston experienced a net-outflow of population. During the same period, Charlestown's population decreased by 4,794 persons or 24%, compared with the City of Boston's overall 8% decrease in population. The closing of the U.S. Naval Shipyard has not had any severe effect on Charlestown's number of residents and recent City population counts accomplished by the City's Elections Department show an increasing population presently. In fact, the City as a whole has experienced a net in-migration starting around 1970.

Charlestown has traditionally been viewed as an ethnic Irish, working class community. As seen in Table IX.C-7, 40% of the resident population is of Irish descent.

Data in Table IX.C-8 shows the Boston Redevelopment Authority's population projections for the City and for Charlestown to 1985. They project an average annual population increase of 4,893 persons for the City of Boston of which 472 annually are anticipated for Charlestown.

housing
characteris-
tics

Charlestown's residences are virtually surrounded by a belt of industrial activities. Inside of this perimeter exists a unique residential community made up of mostly older housing which reflects the rich history of the area. Many of the houses are multi-family, often in rowhouse configuration. Data in Table IX.C-9 shows the predominance of renter-occupied units. Thirty-two percent of all housing units were occupied by owners in 1970. This percentage is significantly higher than that for the City as a whole, where only 27% of the units are owner occupied.

Local realtors in Charlestown report that housing for sale and for rent has experienced increased demand from Boston's downtown

workers. These persons are typically young professionals who are attracted by the lower rent and sale prices as well as by the charm of Charlestown's neighborhoods. Although housing costs less in Charlestown than in other desirable parts of Boston, the newcomers are paying more than traditionally have been paid for housing in the area, and prices are rising accordingly. With the demolition of the elevated transit line, along with construction of a neighborhood shopping mall in the Thompson Square area, the desirability of housing in Charlestown should continue to rise. This increased desirability will be accompanied by higher rental and sale prices in some areas. The majority of the housing can be expected to stay in the hands of long-term Charlestown residents. This characteristic shows up in the proportion of residents who have lived more than 5 years in the same unit. This proportion rose from 52% to 64% between 1960 and 1970.

Charlestown is expected to remain a family-oriented area with the average household size to remain at 2.9 persons in the foreseeable future. Data in Table IX.C-10 shows the historical trends in household size for the City of Boston and Charlestown, and also projects household size for 1980 and 1985. In 1950, the average household size in Charlestown was 4.5 persons as opposed to 3.6 persons in the City of Boston overall. Since that time the propensity to have smaller families in Charlestown has coincided closely with the rest of Boston where in 1970 an average of 2.9 persons per household was reported compared to an average of 3.1 in Charlestown.

employment characteristics and income

Trends in employment are shown by data in Table IX.C-1 for the City of Boston. The covered employment data shows a clear loss in manufacturing employment. The City lost 24,300 manufacturing jobs from 1960 to 1970. In the same period the total employment in the Finance, Insurance, and Real Estate (FIRE) Industry advanced by 17,900 jobs and the Services Industry advanced by 28,700 jobs.

As shown by data in Table IV.C-2, the 1970 census survey of person/resident in Charlestown indicated that the largest segment of the work force there were involved in Clerical occupations. This sector would be in strong demand by the two largest growth industries -- FIRE, and Services. Charlestown has a markedly small proportion (9%) of its workers involved in Professional and Technical occupations when compared to the City of Boston's work force (17%).

The 1969 median family income for Charlestown was \$8,827. This amount was only \$306 less than the median for the City of Boston which was \$9,133. Data in Table IX.C-3 shows the percent distribution of income for Charlestown and the City as a whole. These figures correspond with the occupational distributions referred to earlier. Charlestown shows a larger percentage than the City in the \$7,000 to \$9,999 income range where its clerical workers and craftsmen's income would occur. In the upper-income areas Charlestown's smaller percentage representation is also reflected in its comparative lack of a larger segment of professional, technical, and managerial workers.

Table IX.C-4 shows the distribution of income by source in Charlestown for families and unrelated individuals. Fifty two percent reported their primary source as wage and salary; 2% were self-employed; 17% collected social-security (included also in this category is Railroad Retirement pay); 9% were welfare recipients or other public assist; and 20% reported 'other' sources of income.

Table IX.C-1
TRENDS IN TOTAL EMPLOYMENT,
CITY OF BOSTON 1960-1970
(In Thousands)

<u>Industry</u>	<u>1960</u>	<u>1965</u>	<u>1970</u>	<u>Change: 1960-1970</u>
Agriculture and Mining	1.4	1.3	0.6	(0.8)
Construction	16.9	17.1	19.3	2.4
Manufacturing	87.4	77.4	63.1	(24.3)
Transportation, Communi- cation, Public Utilities	44.6	39.0	42.0	(2.6)
Wholesale Trade	45.4	42.0	40.0	(5.4)
Retail Trade	76.7	74.3	77.2	0.5
Finance, Insurance, Real Estate	53.5	56.8	71.4	17.9
Services	83.0	91.9	111.7	28.7
Government	92.7	97.6	102.5	9.8
TOTAL ¹	501.6	497.4	527.9	26.3

¹ May not add, due to rounding.

Source: Boston Redevelopment Authority, and Economics Research Associates.

Table IX.C-2

CITY OF BOSTON AND CHARLESTOWN EMPLOYMENT CHARACTERISTICS

	<u>Percent Distribution</u>	
	<u>Charlestown</u>	<u>Boston</u>
Professional, Technical, and Kindred Workers	9%	17%
Managers and Administrators	3	6
Sales Workers	4	6
Clerical and Kindred Workers	30	27
Craftsmen, Foremen, and Kindred Workers	13	10
Operatives (except Transport)	10	11
Transport Equipment Operatives	4	3
Laborers	10	4
Service Workers	17	16
Total Workers	100%	100%

Source: 1970 Census of Population and Housing, 4th Count Summary,
Economics Research Associates

Table IX.C-3

PERCENT DISTRIBUTION OF FAMILY INCOME,
BOSTON AND CHARLESTOWN, 1969

	Total Families	Less Than \$1,000	\$1,000- 1,999	\$2,000- 2,999	\$3,000- 3,999	\$4,000- 6,999	\$7,000- 9,999	\$10,000- 14,999	\$15,000- 24,999	\$25,000- Or More	Median
Charlestown	3,517	3.0	3.4	5.5	5.2	18.3	25.0	23.0	13.6	3.0	\$8,827
Boston	142,019	2.8	2.7	4.9	5.6	18.5	21.7	25.7	14.8	3.3	\$9,133

Source: 1970 Census of Population and Housing, Fourth Count Summary Tape and Economics Research Associates

Table IX.C-4

DISTRIBUTION OF INCOME BY SOURCES IN CHARLESTOWN

Wage and Salary	52%
Self-Employed	2%
Social Security or Railroad Retirement	17%
Public Assist/Welfare Payments	9%
All Other Income	20%

Source: 1970 Census of Housing and Population, 4th Count Summary and
Economics Research Associates

Table IX.C-5

Trend in Container Movements at Moran Container Terminal

	Fill in		Fill out		Empty out		Total Cont.
	20'	40'	20'	40'	20'	40'	In & Out
1972	4,868	2,943	1,656	1,557	2,885	1,098	15,007
1973	8,058	6,411	4,051	4,899	2,378	1,079	26,876
1974	8,337	7,625	5,765	6,921	1,721	633	31,002
1975 (Jan. to May)	566	500	354	553	269	137	2,379
Totals:	21,829	17,479	11,826	13,930	7,253	2,947	75,264

Source: Massport, Moran Container Terminal

Table IX.C-6

VISITATION AT CHARLESTOWN
WATERFRONT VISITOR ATTRACTIONS
(Thousands of Visitors)

	U.S.S. <u>Constitution</u>	Raytheon Historical <u>Theater</u>
1965	508	-
1966	456	-
1967	423	-
1968	531	-
1969	709	-
1970	674	-
1971	617	-
1972	637	-
1973	300 ¹	-
1974	275 ¹	-
1975	850 ²	91 ³

¹ Ship in dry dock and closed to public from 4/16/73 - 3/14/75. Visitation is at Museum only during this period.

² Projected by Naval Shipyard based on growth trend since 1969. Actual visitation from 1/1-9/30/75 was 693,746.

³ Theater opened June 17, 1975

Source: As noted and Economics Research Associates

Table IX.C-7

Ethnic Composition of Boston and Charlestown

	Irish	Italian	Canadian	Black	Other
Charlestown	40%	14%	20%	0.5%	25%
Boston Overall	22%	14%	20%	16.3%	28%

Source: 1970 Census and Economics Research Associates.

Table IX.C-8

CURRENT POPULATION ESTIMATES AND PROJECTIONS,
CITY OF BOSTON AND SELECTED COMMUNITIES

	<u>1972</u> ¹	<u>1982</u> ²	<u>Total Increase</u>	<u>Average Annual Increase</u>	<u>1985</u>
City of Boston	659,230	708,162	48,932	4,893	723,850
Charlestown	16,156	21,872	5,716	572	23,600

¹ Police Department, City of Boston, Census of Population 17 Years of Age and Over; and BRA.

² BRA Target Projections.

Source: As noted, and Economics Research Associates.

Table IX.C-9

SELECTED HOUSING STOCK CHARACTERISTICS,
CITY OF BOSTON AND CHARLESTOWN
1970

	Total Housing Units	Occupied Units		Renter Occupied Units		Owner Occupied Units	
		Number	Percent of Total	Number	Percent of Occupied	Number	Percent of Occupied
City of Boston	232,448	217,622	93.6%	158,392	72.8%	59,230	27.2%
Charlestown	5,119	4,815	94.1%	3,256	67.6%	1,559	32.4%

Source: 1970 Census of Population and Housing; Boston Redevelopment Authority; and Economics Research Associates.

Table IX.C-10

TRENDS IN HOUSEHOLD SIZE,
CITY OF BOSTON AND CHARLESTOWN, 1950-1985

<u>Area</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1980</u> ¹	<u>1985</u> ²
City of Boston	3.6	2.9	2.7	2.7	2.6
Charlestown	4.5	3.1	3.0	2.9	2.9

¹ Boston Redevelopment Authority Projection.

² Economics Research Associates Estimates.

Source: As noted; U.S. Census.







CITY OF BOSTON
PARKS AND RECREATION DEPARTMENT

ONE CITY HALL SQUARE

BOSTON, MASS. 02201

*Olden
Fawcett
Horsman
Morrison*

FRANK G. MEADE
Commissioner

KEVIN H. WHITE
Mayor

May 27, 1976

RECEIVED

MAY 27 1976

Mr. Walter Brooks
Transportation Planning Officer
Transportation Planning Department
Boston Redevelopment Authority
One City Hall Square
Boston, MA 02201

TRANSPORTATION
PLANNING DIVISION

Dear Mr. Brooks:

The following is a true copy of the minutes of the meeting of the Board of Parks and Recreation Commission held January 21, 1976, Room 801, Boston City Hall.

If you will note, the Commission, to be cooperative and to support the low level bridge across the channel, expressed the hope that your plans would incorporate the removal of the concrete grandstand. It is not an either/or vote. It is still the hope of the Commission that this work be done.

Parks and Recreation Commission Meeting - January 21, 1976

Section I. 2. B.R.A. seeking clarification of jurisdiction over parcel of land adjacent to Barry Playground, Charlestown and significance or non-significance of parcel of land for Boston Parks and Recreation Department planning purposes.

Present: Walter Brooks, Transportation Planner, B.R.A.
Arthur Reilly, Project Director, B.R.A.

Mr. Brooks: We propose a low-level bridge across the channel linking Chelsea Street with Terminal Street. There are (300) trucks per day. The marine launch area is set back from Terminal Street. The problem is the placement of supporting columns under the bridge. In order to facilitate we need 1/10 acre (4,200 sq.ft.) of land. Boats will be able to use the channel. The clearance is 10' above high water. To go any higher would overshoot Terminal Street.

Mr. Walter Brooks
May 27, 1976
Page 2

Frank Clark: If concrete grandstand was removed, it would remove an eyesore.

Mr. Reilly: We could include that in the plans.

Mr. Reilly: There will be an overpass. There will be 1,000 kids at the Charlestown High School. We want to get truck traffic out of there.

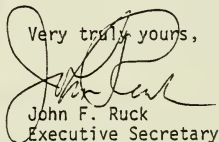
Comr. Scott: I move to grant this with the hope of getting other improvements.

Mr. Reilly: We will guarantee the improvements you request will be put into the plans. If we get this we guarantee to take all things into consideration.

Comr. Curran: Seconded Motion.

VOTE: Unanimously Affirmative.

Very truly yours,

A handwritten signature in dark ink, appearing to read "John F. Ruck", is written over the typed name and title. The signature is fluid and cursive, with the first name "John" being particularly prominent.

John F. Ruck
Executive Secretary

October 15, 1975

Mr. Roland Burke
Chief Planner
Planning and Development Department
Boston Housing Authority
53 State Street
Boston, Massachusetts

Dear Mr. Burke:

As discussed recently with you and Mr. Donovan, the city is proposing certain local transportation improvements in Charlestown which are aimed at removing trucks and extraneous through-traffic from Lowney Way and the eastern section of Medford Street between Terminal and Chelsea Streets. As the area is heavily residential in nature, having both Bunker Hill and Charles Newtown housing, the planned improvements have been favorably received by the Charlestown community and have their support.

Currently a Draft Environmental Impact Statement (DEIS) is being conducted for a proposed connection of Chelsea and Water Streets in the City Square area and the construction of a low-level bridge across the Little Mystic Channel thereby linking Chelsea Street directly with the Terminal Street industrial area. The DEIS is being conducted jointly by the Boston Redevelopment Authority and Massport in coordination with the Massachusetts Department of Public Works and in accordance with state and federal EIS requirements.

In addition to relieving traffic pressures on local Charlestown streets, the proposed Chelsea-Water Connection will provide improved access to the northern sector of the Navy Yard for development purposes. In order to achieve proper roadway alignment and enhance pedestrian linkages between the community, the Navy Yard and the recently expanded National Park site, it may prove desirable to obtain a small section of BHA land located between the Tobin Bridge right-of-way and bordering on Chelsea Street. The attached illustration shows the general alignment of the proposed roadway connection and the BHA land parcel.

Mr. Roland Burke (continued)

As part of the work scope to be covered in the current DEIS, I am seeking clarification from the Boston Housing Authority on the following items: (1) the nature of BHA jurisdiction over this parcel and (2) the significance or non-significance of this parcel for BHA planning purposes.

I would appreciate your assistance in furnishing the above information and providing us with an indication of BHA's views on the land parcel in question. We would like to incorporate this information in summary form into the current Draft Environmental Impact Statement.

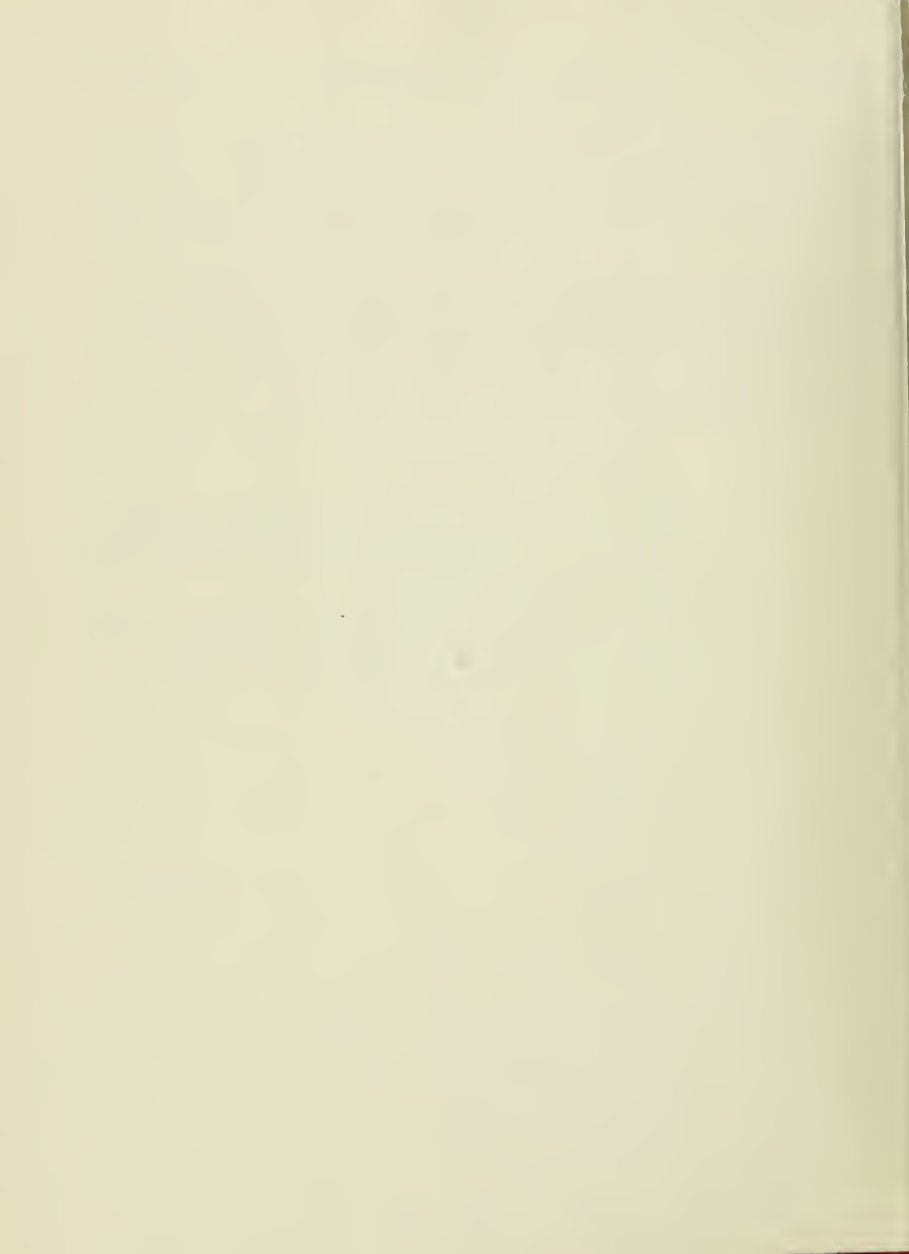
Thank you for your continuing interest in this important matter.

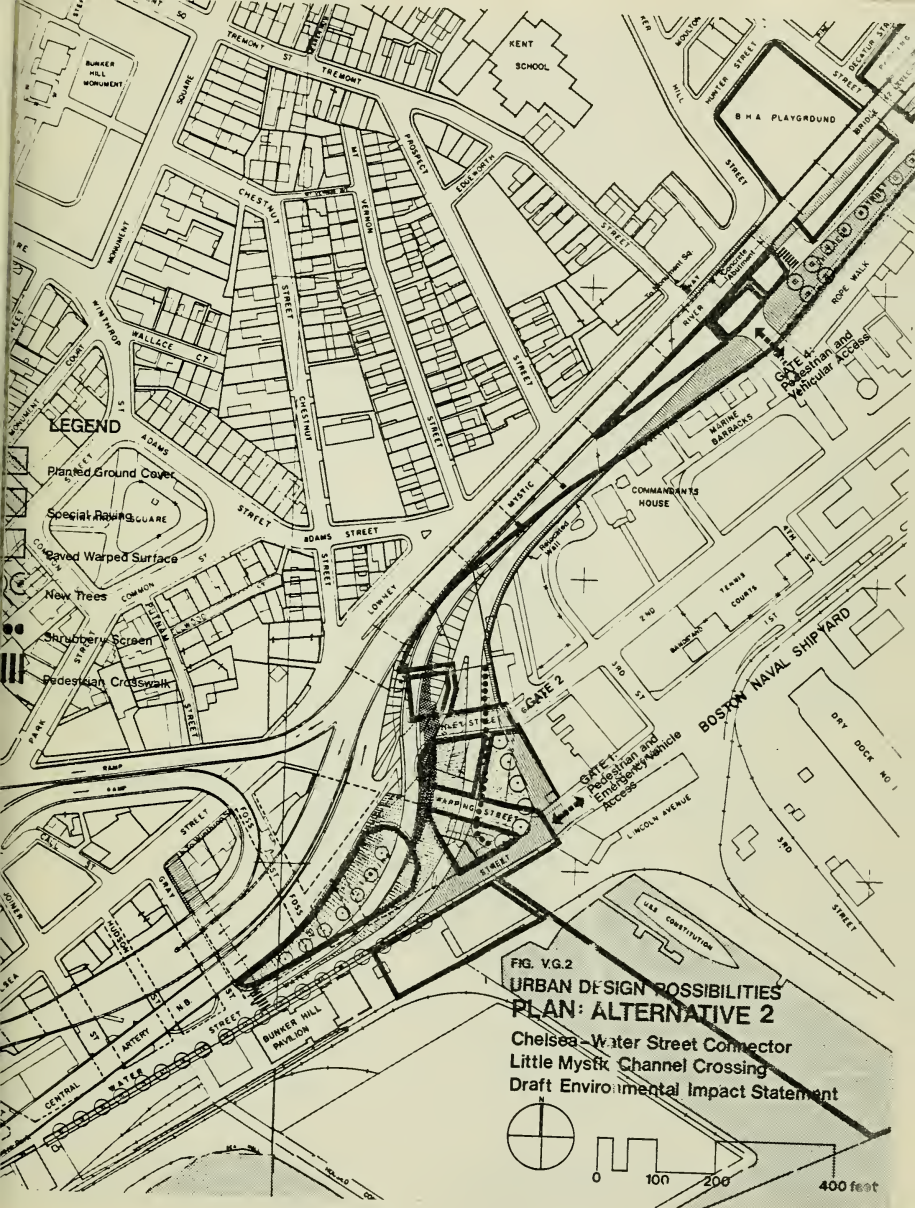
Very truly yours,

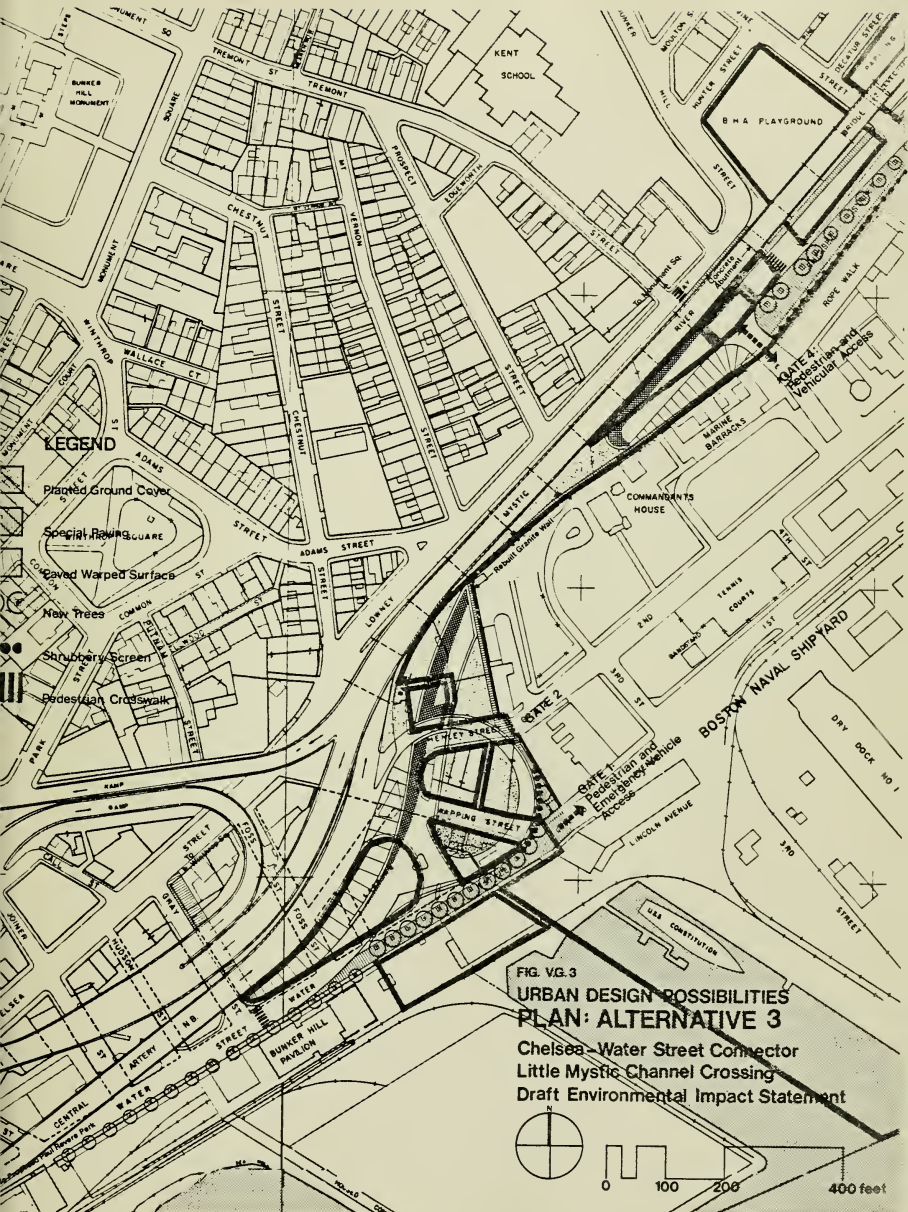
Alfred R. Howard
Alfred R. Howard
Transportation Planning Director

CC: Leo Donovan, BHA
Robert Horigan, MDPW
Walter Brooks, BRA

Attachment











EDWARDS AND KELCEY, INC.

470 ATLANTIC AVE., BOSTON, MASSACHUSETTS 02210
AREA CODE 617 542-4576



February 27, 1975

RECEIVED

FEB 28 1975

Commander
First Coast Guard District (OAN-1)
150 Causeway Street
Boston, Massachusetts 02214

WALLACE FLOYD ELLENZWIG MOORE INC.

Subject: Bridge Crossing
Chelsea Street over Little Mystic Channel

Dear Sir:

The firm of Edwards and Kelcey, Inc., is part of a design team that has been retained by the Boston Redevelopment Authority and Massachusetts Port Authority to prepare a Draft Environmental Impact Statement for a connection of Chelsea and Water Streets and a bridge crossing over the Little Mystic Channel in Charlestown.

Part of our work will involve a bridge type study for a span over the Little Mystic Channel. The site was once the location of bascule bridge that was removed to the top of the piers in 1956, after completion of the Mystic Tobin Bridge. The old bridge provided a 75' wide channel.

To aid our work we request guidance on a proposed channel location, width and bridge underclearance.

We are attaching sketches of the area, noting possible channel sites. It would be advantageous for a fixed bridge, if the channel would be relocated from the center of the channel to the south side (Navy Yard). This would help in meeting the grades on both sides.

We note that the State has recently built a boat launching ramp to the west of the site, and that the Bunker Hill Yacht Club has a float adjacent to the area.

In order to expedite our study, your earliest consideration of this matter will be most appreciated.

If you have any questions in this regard, please feel free to contact us.

Very truly yours,

EDWARDS AND KELCEY, INC.

Anthony C. Centore, P.E.
Project Engineer

CC: Wallace
Attachments
NEWARK MINNEAPOLIS • NEW YORK • PHILADELPHIA • GAINESVILLE, FLA.

ASC/mb

COPY



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS
COMMANDER (0an-1)
FIRST COAST GUARD DISTRICT
150 CAUSEWAY STREET
BOSTON, MASS. 02114
Tel: 617-223-3632

3270

27 MAR 1975

Edwards & Kelcey, Inc.
470 Atlantic Avenue
Boston, MA 02210

Attention: Mr. A. C. Centore

Gentlemen:

The alignments for the proposed Little Mystic Channel crossing submitted with your letter of 27 February 1975 have been reviewed. In general, neither proposal appears to be objectionable.

The relocation of the boat channel, as contemplated for the direct crossing scheme, would be acceptable as long as safe passage below, through, and above the bridge is provided.

Substantive information about the use of the Commonwealth of Massachusetts boat launching ramp located above the proposed crossing site apparently does not exist. The meager knowledge that has been obtained indicates that only small power boats are launched from the ramp. A vertical clearance of 10 feet above mean high water and a horizontal opening of 75 feet should provide adequate passage for this traffic.

The vertical and horizontal clearances that will be recommended to the Commandant for approval cannot be determined at this time. When a formal request for approval of the location and plan of the proposed bridge has been received in this office, a public notice will be issued to all interested parties. The data received in response to the notice together with a comprehensive study of present traffic using the waterway and the traffic which may reasonably be expected to use the waterway in the foreseeable future must determine the clearances that can be recommended to the Commandant.

The existing bridge piers are to be removed to the natural bottom of the channel if they are not used for the proposed crossing.

27 MAR 1975

If further information is desired, do not hesitate to contact this office.

Sincerely,

W. J. Naulty

W. J. NAULTY
Administrative Assistant for Bridges
By direction of the Commander
First Coast Guard District



APPENDIX L

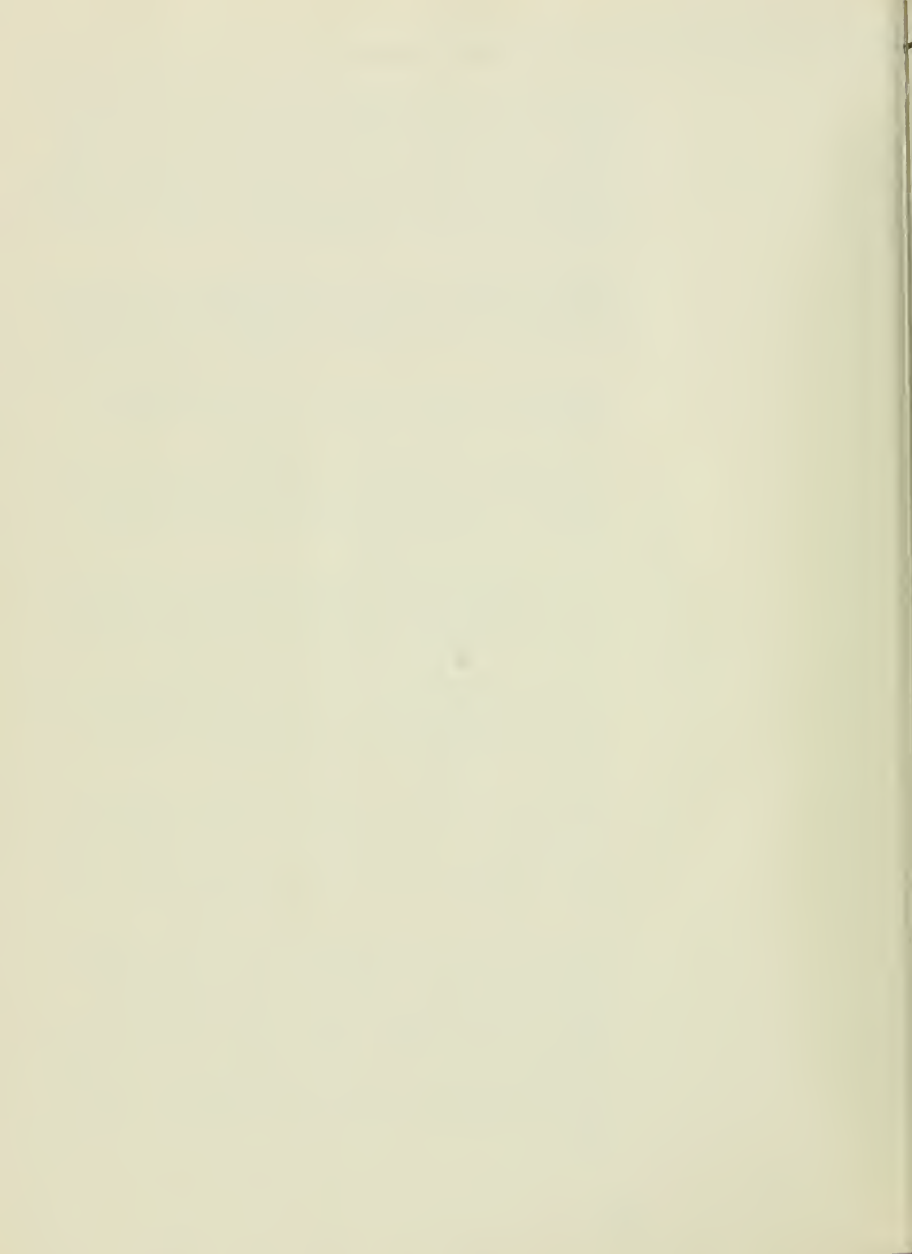
Affected Shipyard Vegetation



A preliminary survey suggests that it should be possible to recreate the existing leafy garden shaded character of the corner of the Shipyard affected if Alternative 4 is implemented. Figure L.1 is a 1"=4'- plan of the existing Shipyard with Alternative 4 and a 10' wide construction casement superimposed. Major trees and shrubs are shown in their approximate locations; key numbers refer to Table L.1 which identifies potentially affected flora.

A careful design study would be necessary to ensure that all possible planning measures had been undertaken to minimize harm and recreate the historic and aesthetic character of the area south of the Commandant's House. It is suggested that the following factors be considered in any such design.

- . Coordination with National Park Service and Advisory Council on Historic Preservation to define objectives of design and ensure their achievement.
- . Redesign of the open space, landscaping, driveway, and relocation/reconstruction of the granite wall should be coordinated to achieve maximum historic and aesthetic benefits. Several alternatives, including cost estimates, should be evaluated.
- . Design of these compensatory measures should also be coordinated with final engineering design of Alternative 4. Coordination of construction staging will be particularly important to minimize the period of disruption as well as to coincide with growing seasons.
- . No "rare specimen" is involved or affected by Alternative 4. The only rare tree is a large tulip tree (Key No. 48) near the southeast corner of the Commandant's House; it is not affected by direct takings and it need not be disturbed by alterations to the driveway.
- . There are relatively few specimens of horticultural interest. Two of these are large, handsomely branched Trees of Heaven (Key No. 34, 35), a common urban species; but they are so large and close to the wall that it is not practical to transplant them. A particularly fine Holly Bush (Key No. 47) is worth transplanting to an island in the middle of a redesigned driveway.
- . It is possible to transplant a number of other trees or shrubs, but the risk and expense do not seem warranted. In many instances it is cheaper to get a new specimen from a nursery than to dig up, hold, and replant an existing tree or shrub. This category includes such flora as Japanese Maples (Key No. 12, 21), Norway Maples (Key No. 6, 7), a Sargent Cherry (Key No. 25), Flowering Crabapples (Key No. 10, 27) and other smaller specimens.
- . While the driveway will have to be redesigned, it does not appear necessary to change the location of its eastern edge.



- . In recent years, the Commandant's House (Quarters G) has been the residence of the U. S. Navy Admiral in charge of the First Naval District headquartered in Boston. This district will shortly be moved to Philadelphia, PA. As a result, future use of Quarters G is uncertain. The Navy may retain it for occasional use or it may become part of the National Historical Park.
- . The garden west of Quarters G will also have to be redesigned to compensate for the closer presence of the wall.

Sensitive landscape design and coordination with the agencies involved would enable satisfactory resolution of these issues.

TABLE L.1.

SHIPYARD FLORA POTENTIALLY AFFECTED BY ALTERNATIVE 4

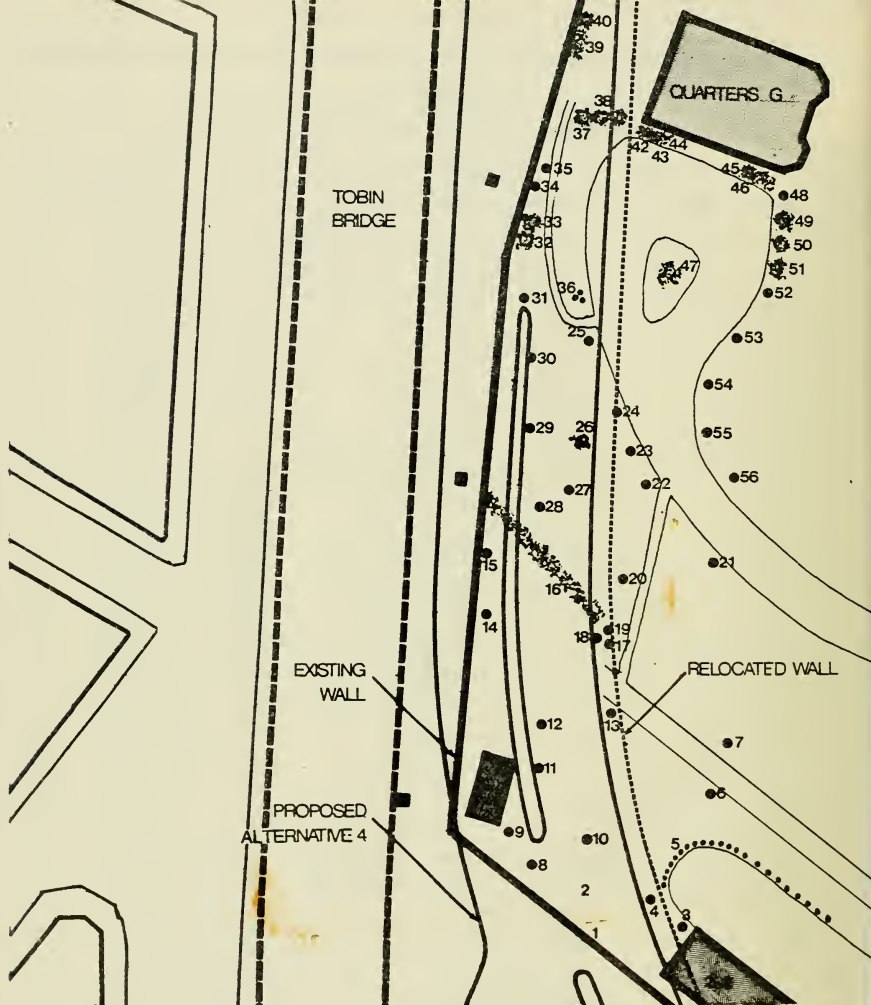
KEY	COMMON NAME	SCIENTIFIC NAME	DIAM.
1	Boston Ivy	Parlhenocissus quincilefolia	N/A
2	Grass	Var. species	N/A
3	Tree of Heaven	Ailanthus altissima	23"
4	White Ash	Fraxinus americana	19"
5	Arbor Vitae	Thuja	2"-3"
6	Norway Maple	Acer platanoides	7"
7	Norway Maple	Acer platanoides	8"
8	Sycamore Maple	Acer pseudoplatanus	6"
9	Butternut	Juglans cinerea	12"
10	Flowering Crabapple	Malus floribunda	10"
11	English Elm	Ulmus procera	12"
12	Japanese Maple	Acer japonicum	4"
13	Norway Maple	Acer platanoides	12"
14	American Elm	Ulmus americana	17"
15	Norway Maple	Acer platanoides	4"
16	Forsythia	Forsythia	N/A
17	Sycamore Maple	Acer pseudoplatanus	2"
18	White Oak	Quercus alba	3"
19	White Oak	Quercus alba	2"
20	Red Maple	Acer rubrum	3"
21	Mulberry	Morus	12"
22	Apple	Malus	25"
23	Japanese Maple	Acer japonicum	3"
24	Weeping Cherry	Prunus	2"
25	Sargent Cherry	Prunus sargentii	5"
26	Star Magnolia	Magnolia stellata	N/A
27	Flowering Crabapple	Malus floribunda	3"
28	Sycamore Maple	Acer pseudoplatanus	9"
29	Mulberry	Morus	19"
30	Apple	Malus	17"
31	Apple	Malus	15"
32	Rose	Rosa	N/A
33	Floribunda Rose	Rosa floribunda	N/A

TABLE 1

SHIPYARD FLORA POTENTIALLY AFFECTED BY ALTERNATIVE 4

(continued)

BY	COMMON NAME	SCIENTIFIC ANME	DIAM.
14	Tree of Heaven	Ailanthus altissima	16"
15	Tree of Heaven	Ailanthus altissima	19"
16	Rose of Sharon	Hibiscus Syriacus	3"
17	Viburnum	Viburnum	N/A
18	Spirea	Spirea	N/A
19	Azalea	Rhododendrum	N/A
20	Juniper	Juniperus	N/A
21	Tree of Heaven	Ailanthus altissima	24"
22	Juniper	Juniperus taxus	N/A
23	Yew	Rhododendron	N/A
24	Azalea	Rhododendron	N/A
25	Juniper	Juniperus taxus	N/A
26	Yew	Taxus biccata	N/A
27	Holly	Ilex crenata	12"
28	Tulip tree	Liriodendron tulipifera	36"
29	Forsythia	Forsythia	N/A
30	Hackberry	Celtis occidentalis	N/A
31	Viburnum	Viburnum	N/A
32	Red Maple	Acer rubrum	18"
33	Weeping Cherry	Prunus	6"
34	Norway Maple	Acer platanoides	12"
35	Flowering Crabapple	Malus floribunda	12"
36	Flowering Crabapple	Malus floribunda	12"



Legend

- TREES
- BUSHES

NQ. REFERS
TO TABLE L1



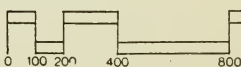
AFFECTED BUILDINGS

UNAFFECTED BLDG.

Figure L.1

Affected Shipyard Plants and Buildings

Chelsea - Water Streets Connector - Little Mystic Channel Cross
Draft Negative Declaration



Property of
BOSTON REDEVELOPMENT AUTHORITY
CHARLESTOWN

U73T.C
Appendix
U.S. Dept. of Transporta-
tion and Mass. Dept. of
Public Works
Chelsea-Water Streets
Connector APPENDIX

DATE	ISSUED TO

CHARLESTOWN

U73T.C
APPENDIX

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